Manitoba

# Annual Report 1986 - 87

## Energy and Mines

# Manitoba

**Minister of**
**Energy and Mines**

Room 301
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-4601

The Honourable George Johnson
Lieutenant Governor of the Province of Manitoba

May it please your Honour:

I have the honour of presenting to you the Annual Report of the Department of Energy and Mines for the fiscal year ending March 31, 1987.

This report records the activities of the Department and the performance of the mineral resources and energy sectors of the province during the year.

Respectfully,

Jerry Storie
Minister

# Manitoba

**Deputy Minister of**
**Energy and Mines**

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The Honourable Jerry Storie
Minister of Energy and Mines

Dear Sir:

I have the honour to present the Annual Report of the Department of Energy and Mines for the fiscal year ending March 31, 1987. The report contains a descriptive and statistical record of activities and achievements in the mineral and energy sectors during the year.

Charles S. Kang
Deputy Minister

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# Department of Energy and Mines

Manitoba is endowed with substantial mineral and energy resources. The development of these resources and subsequent production into commercially attractive and marketable commodities underpins a large part of the socio-economic fabric of the province. Extraction of mineral resources and generation of electricity from hydro resources play an important role in sustaining the economic growth of the province. These resources are viewed as a natural heritage which must be managed prudently, and developed under responsible policy guidelines to ensure that residents of the province, today and in the future, will benefit.

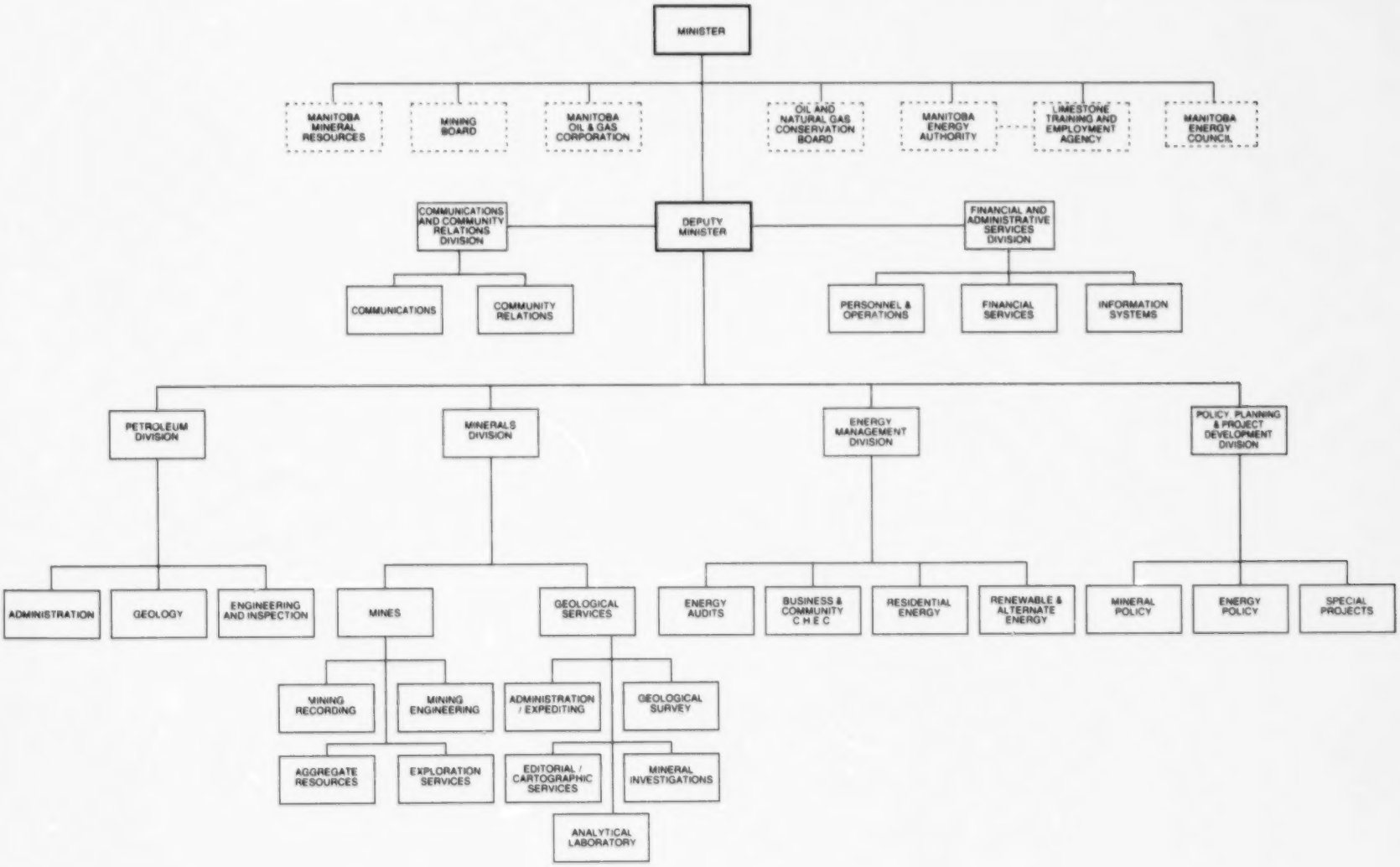
The medium and long-term direction of the department, in addressing its mandate, is to ensure continuity and enhancement of future benefits from provincial mineral and energy resources.

During the year, these functions were carried out by four main divisions — Energy Management, Minerals, Petroleum, and Policy, Planning and Project Development — with support from the Financial and Administrative Services Division, and the Communications and Community Relations Division. Additionally, the Minister held responsibility for the following crown corporations and boards: Manitoba Hydro, Manitoba Mineral Resources Ltd., Manitoba Oil and Gas Corporation, The Mining Board, The Oil and Natural Gas Conservation Board, Manitoba Energy Authority, and Manitoba Energy Council. Manitoba Mineral Resources Ltd., Manitoba Oil and Gas Corporation, and Manitoba Energy Authority produce their own annual reports.

A summary of expenditures of the department for the year ending March 31, 1987 is given in Table 1.

# Organization Chart — Manitoba Energy and Mines

## MANITOBA ENERGY AND MINES DEPARTMENTAL OVERVIEW



# Energy Management

The Energy Management Division is responsible for the promotion of energy conservation and renewable and alternative energy substitution strategies for Manitoba.

The mandate of the division is to:

- develop a broad public awareness of proper energy management.
- provide opportunities for the application of proven technologies.
- cost-effectively reduce energy consumption in all sectors of Manitoba's economy.
- encourage the use of renewable and alternative forms of energy.

Management responsibility is divided into three sectors: Residential; Industrial, Commercial, Institutional and Agricultural; and Renewable and Alternative Energy.

## Residential Sector

### Home CHEC-UP

The Home CHEC-UP program is designed to assist homeowners to conserve energy in their homes by providing impartial advice on implementing a retrofit program. A specially trained Energy Advisor conducts an energy analysis of the home and produces a report outlining an energy conservation program. The report, which is presented to the homeowner, also contains details of the recommended retrofit techniques.

The Home CHEC-UP is free of charge, administered by Energy and Mines, and delivered by Manitoba Hydro. In fiscal year 1986-87, 3,394 homes were analyzed.

### Cut Home Energy Costs (CHEC)

The Cut Home Energy Costs Loan Program (CHEC) provides financial assistance, in the form of two loan options, to homeowners wanting to implement a conservation program.

The first option requires a Home CHEC-UP and provides up to $2,500 to finance the implementation of the Home CHEC-UP Energy Advisors' recommendations. The second option offers up to $1,000, but does not require a Home CHEC-UP. Both loan options have an interest rate of 8 per cent, fixed for three years, and are repayable over a maximum period of 10 years through monthly installments on the homeowner's Hydro bill.

The CHEC Loan Program is administered by Energy and Mines and delivered by Manitoba Hydro and Winnipeg Hydro, in their respective service areas. During fiscal year 1986-87, 3,631 loans valued at $3,091,800 were disbursed. In addition to energy conservation, benefits of the program include the creation of employment opportunities in the province's construction industry and an improved housing stock.

### Home Energy Savers Workshops

Workshops on home energy conservation methods are delivered at local schools throughout the province. During fiscal year 1986-87, 31 workshops were completed with a total of 559 participants. The workshops are also an excellent vehicle for promoting the Home CHEC-UP/CHEC Loan programs.

### How-to-Retrofit Booklets

A series of How-to-Retrofit booklets is being developed to provide homeowners with objective information on proper retrofit techniques. The booklets are written as a detailed guide for the do-it-yourselfer and contractor. Four of the six booklets have been published to date.

### Community-Based Organizations: Energy Conservation Program

The objective of this program is to stimulate energy conservation and create employment opportunities for minorities and special interest groups by making grants available to non-governmental organizations active in energy conservation and alternative energy services.

During fiscal year 1986-87, the following two projects, administered by Energy and Mines, were undertaken:

1. **Kinew Housing** is a non-profit housing corporation that provides low-cost rental accommodation to native families. The Kinew Energy Program funds upgrading and retrofitting of Kinew's homes to reduce energy bills, and thus, provides a major savings for the corporation's low-income tenants. The program also provides training for native people to enhance their job opportunities in the retrofitting and construction industries. For fiscal year 1986-87, 42 homes were retrofitted at a total expenditure of $99,120.
2. **The Age and Opportunity Centre** has established an energy conservation program designed to assist elderly residents to upgrade the energy efficiency of their homes. The program employs an energy coordinator who visits seniors and provides energy advice and assistance to individuals. For fiscal year 1986-87, 188 homes were visited at a total expenditure of $24,010, of which Energy and Mines contributed $20,000.

## Industrial, Commercial, Institutional and Agricultural Sector

### Manitoba Energy Audit Program

The objective of the program is to provide commercial, industrial and institutional energy managers with an understanding of how energy is used in their facilities and how they can manage their operations to improve energy efficiency and reduce costs. Initiated as a cost-shared, federal-provincial program in 1980, the Manitoba Energy Audit Program became a wholly provincial program in 1984.

The on-site energy audit consists of inspecting the facility's operation, analyzing its current energy use, identifying areas for potential savings, presenting the results to the client, and providing advice on implementing energy management measures. A written report follows by mail. With the use of two computer equipped Energy Buses, studies were provided to 188 facilities, identifying $1.8 million worth of potential energy savings. This compares to 190 facilities and $2.0 million in fiscal year 1985-86. Since the beginning of the program in 1980, over 1,200 facilities have been audited, identifying over $18 million worth of potential savings.

A change to smaller, more efficient computers and vehicles was completed this year, resulting in improved program capabilities as well as reduced operating costs. Additionally, a number of special projects were undertaken, such as the evaluation of a new computer program for building simulation, Energy Conservation Week, and a review of energy management systems in Manitoba schools.

### The Energy Manager

The first two issues of The Energy Manager newsletter were produced this year. The new publication uses case studies of Energy Bus clients to promote the opportunities and benefits of increasing energy efficiency. The case studies, which featured St. Paul's United Church in Dauphin and Bristol Aerospace of Winnipeg, provide a low-cost opportunity to promote energy management to a large audience. The newsletter was very well received and four issues are planned for next year.

### Energy Management Seminars

The division assisted in preparing and delivering energy management seminars for the Manitoba Dairy Association, The Canadian Long Term Care Association, and the Manitoba Association of School Trustees. A total of five seminars were co-sponsored with Energy, Mines & Resources Canada and the respective trade associations. It is intended to expand the use of seminars, especially in the school sector, during the next year.

### Business/Community CHEC (Cut High Energy Costs) Grant Program

This grant program ended on March 31, 1987. Business/Community CHEC was an energy conservation grant program to assist Manitoba's small businesses (Business CHEC) and municipalities, institutions, and non-profit organizations (Community CHEC), to undertake energy conservation retrofits. Matching grants of up to $15,000 were provided where projects showed potential for a 20 per cent energy reduction and an anticipated payback period of five years.

Thirty grants totalling $266,796 were approved for 1986-87. Grants paid out, as well as ones carried over from other years, totalled $270,088 in the 1986-87 fiscal year. During the three years of program operation, 269 projects were completed with total construction expenditures in excess of $6 million. A total of $2.4 million in grant funds were disbursed in this highly successful energy conservation program.

### Business/Community CHEC (Cut High Energy Costs) Loan Program

In order to maintain financial assistance for viable energy conservation projects, and at the same time reduce program operating costs, the Business/Community CHEC Loan Program was established.

Participants can now receive loans of up to $32,000 to cover 80 per cent of project costs and repay the loan over a maximum term of five years. The interest rate is the same rate offered to government agencies, and loan payments are sized according to anticipated energy savings.

Fifty-one applications were received up to March 31, 1987, and a total of $170,100 in loan funds were approved. Response to the program remains steady.

## Renewable and Alternative Energy Sector

### Ethanol from Cellulose

Manitoba contributed $21,080 in 1986-87 to complete a feasibility study for a cellulose conversion process that could be installed at the Mohawk Oil fuel ethanol production plant in Minnedosa to reduce the cost of ethanol production. The total cost of the study was $237,150, jointly funded by Manitoba Energy and Mines, Energy, Mines & Resources Canada, and the Monenco-Iotech Corporation.

The study was based on results from a one ton/day pilot plant operated by Monenco and Iotech in Ottawa. The study indicated that the cost of ethanol is highly dependent on revenue from the sale of lignin, a by-product of the process. Mohawk Oil is reconsidering the process until the value and markets for lignin can be more firmly established. In addition, a fall in grain prices in 1986-87 improved the economics of the existing grain-based facility, decreasing the incentive for conversion.

## Canada-Manitoba Agreement on Conservation and Alternative Energy

An agreement was signed in June of 1986 which allows for joint funding of demonstration projects by Manitoba Energy and Mines (MEM) and Energy, Mines and Resources Canada (EM&R). The agreement is in effect until March 31, 1988.

Six projects were funded under the agreement in fiscal 1986-87. Energy, Mines & Resources Canada provided matching funding in each case.

1. **Ground Source Heat Pump Demonstration:**
   A techno-economic and market study of the potential use of ground source heat pumps for heating and cooling of industrial, commercial and institutional buildings was undertaken. In fiscal 1986-87, $2,127 was expended of the total $32,526 contracted by MEM to the Industrial Technology Centre, Manitoba Research Council for the study. Subject to the contractor's recommendations a demonstration program may be funded. The report is due in March 1988.
2. **Demonstration of the Connor Shea Zero-Till Seed Drill for Pastureland Rejuvenation:**
   The Prairie Agricultural Machinery Institute received MEM funding of $2,687 in 1986-87 towards the demonstration of a novel, low-energy, soil-conserving seeding device. A report on the machine and one year of agronomic performance will be submitted in March 1988.
3. **Heat Upgrading Opportunities for Manitoba's Food Processing Industry:**
   W.L. Wardrop and Associates Ltd. of Winnipeg received $6,660 in 1986-87 to study technologies for reclaiming waste heat for re-use in food processing operations. A report received in March 1987 identified several opportunities for the industry.
4. **Ethanol Production from Potato Processing Wastes:**
   In fiscal 1986-87, W.L. Wardrop and Associates Ltd. received $13,500 in funding towards a study of the techno-economic feasibility of producing ethanol from starchy wastes at Carnation Foods' Carberry potato processing plant. The report is due in February 1988.
5. **Energy Management Seminar — Manitoba Association of School Trustees:**
   The Manitoba Association of School Trustees received $5,690 funding to prepare and host a one-day seminar for education facilities' supervisors on energy management opportunities in schools. Sixty-five supervisors attended. MEM and EM&R Canada directed and provided human resources for this very successful seminar. Similar seminars are planned in 1987-88 for other groups.
6. **Manitoba Energy Conservation Week:**
   MEM contributed funding and staff time towards the promotion and running of Manitoba Energy Conservation Week, held March 2-8, 1987. Activities included home energy-saver workshops, public service announcements, media presentations, a poster contest and tours of an energy-efficient industrial complex. A similar program is planned for 1987-88.

## Manitoba Energy Council

The Manitoba Energy Council is a citizens' advisory group appointed by the Minister. The council consists of a chairperson, secretary, and eight members. The council provides the Minister with assessments and recommendations concerning energy policy and conservation programs.

# Minerals Division

The Minerals Division is responsible for the administration and management of the provincial mineral resources.

The mandate of the division is to:

- administer The Mines Act and Regulations governing the disposition of metallic and quarry mineral rights, and the exploration, development and production of provincial mineral resources.
- develop and implement mineral resource programs in response to changing technologies, the state of the mining industry, and government policy.
- conduct geological investigations directed towards providing a data base for mineral resource exploration, evaluation and development.
- monitor the effect of provincial mineral policy on the mining industry of the province and participate in mineral policy formulation and implementation.
- negotiate mineral resource development arrangements with potential developers and with federal government agencies.
- provide advice to other provincial and federal agencies on matters relating to the environment, land use planning, regional development, etc.

## Geological Services

The Geological Services Branch comprises four sections: Geological Survey, Mineral Investigations, Analytical Laboratory, and Editorial and Cartographic Services.

The Geological Survey and Mineral Investigations Sections undertake geological mapping, mineral deposit studies and other geoscientific investigations designed to provide an up-to-date geological framework and mineral data base for the province for use in mineral resource appraisal, land-use planning, and in addressing environmental concerns.

The Analytical Laboratory Section provides the necessary analytical support for the branch's geological and mineral evaluation activities. The Editorial and Cartographic Services Section is responsible for drafting and preparing all maps, graphs, charts and illustrations for the Minerals Division, and editing all branch publications and reports.

In this, the third year of the Canada-Manitoba Mineral Development Agreement (1984-89)*, an accelerated level of industry-supportive, minerals-oriented programming was again mounted by Manitoba Energy and Mines in concert with parallel program delivery by Energy, Mines & Resources Canada.

* *A subsidiary agreement of the Economic and Regional Development Agreement (ERDA).*

The joint federal-provincial workplan for 1986-87 was approved by the agreements management committee in February 1986, and copies distributed in March to members of the newly constituted Mining and Mineral Exploration Liaison Committees.

The Sector A Geoscientific Program encompassed 55 provincial and 22 federal projects, with operational budgets of one million and two million dollars, respectively. In large part, the projects were conducted by staff of the Manitoba Geological Services Branch (MGSB) and the Geological Survey of Canada (GSC).

Although provincial Sector A budgets were reduced to 66 per cent of those available in 1985, efforts were still maintained in all districts of concern, with a special focus on the Lynn Lake-Ruttan and Flin Flon-Snow Lake mineral belts. The initial field objectives for several projects were attained and the stage set for data compilation analysis and final report production during the concluding years of the agreement.

Briefing sessions were given in each of the northern mining districts and a complete review of all MDA activities was presented to the Winnipeg section of the Canadian Institute of Metallurgy (CIM) in April prior to the field season. Government-industry field tours and demonstrations were held in the Thompson and Flin Flon-Snow Lake areas. However, an extensive demonstration planned for the Cross Lake region had to be postponed in the face of extraordinarily high water levels on the Nelson River, a factor which also necessitated radical rescheduling of mapping programs planned for the Jenpeg region.

A progress report covering all aspects of Sector A programming during fiscal year 1985-86 was released in August 1986. Other Open File reports were released throughout the year, together with numerous brochures on various aspects of agreement programming.

MGSB staff provided input to other MDA sectoral activities, including drilling of tailings at Sherridon and Flin Flon, dimension stone site-selection in southeast Manitoba, acquisition of kaolin samples from Black Island for beneficiation studies by CANMET, and editorial and technical input to brochures on industrial minerals, gold, basal till studies, educational programs, and a contracted evaluation of feldspar from Bernic Lake.

Enquiries from the private sector focussed principally on gold and platinum, with an equivalent level of demand for information on industrial minerals including high-calcium limestone, silica, gypsum, kaolin, building stone, peat and crushed stone (dolomite).

The MDA continues to assist the branch in generating useful, timely and pragmatic geoscientific information as a backdrop and underpinning to exploration initiatives in the province. As well, it encourages a high level of dialogue between all interested parties.

In addition to its MDA commitments, the provincial Geological Services Branch also contributed to a workshop in April 1986, at the University of Manitoba. Discussions led to the formation of a steering committee and the formulation of a proposal for a lithoprobe geophysical and geological transect of the Trans-Hudson Orogen, with co-ordinated participation by universities in Manitoba and Saskatchewan. If accepted, the proposal could lead to the generation of unique data on megascopic crustal features associated with the Churchill-Superior Province boundary, as well as additional near-surface data of use to the mining sector.

Studies of Quaternary deposits led to joint MGSB/GSC involvement in the regional documentation of the Gillam area, as well as provincial participation in the EM&R-sponsored reconnaissance of sea-floor sediments and submarine resources in Hudson Bay.

A Devonian outcrop belt tour provided to Home Oil reportedly was helpful in interpreting reef structures in Saskatchewan and in the subsequent discovery of a producing well in that province.

MGSB staff collaborated in other research projects involving U-Pb* geochronology (University of Kansas); fluid inclusion studies, geothermobarometry of the Pikwitonei region; petrographic investigation of the Namew Lake deposit (University of Regina); and continuing co-operative studies with geologists from NASA on anorthosites from the Pikwitonei region and elsewhere in the province.

## Lynn Lake-Ruttan District (including Northern Churchill Province)

Documentation of mineral deposits in the Lynn Lake area was completed as a first step to creating a mineral deposit inventory for the district. Detailed mapping and geochemical sampling at Sheila, Ralph, Spider, Farley and Motriuk Lakes compared these sections with those of the MacLellan gold mine, and extended the Agassiz Metallotect at least five kilometres southwest of Lynn Lake to Margaret Lake. Other settings of gold mineralization between Franklin and Wasekwan Lakes were also investigated, as was the relationship between stratigraphy and base metal mineralization in the Lynn Lake Rhyolite complex, and the West Anomaly near Ruttan.

Vegetation studies at the MacLellan Mine, Spider, Farley and Dot Lakes (as well as the Ferguson Mine near Herblet Lake) encountered much lower levels of trace gold in alder twigs than has been recorded from control studies in Saskatchewan. It was concluded that the gold contents of ash from alder twigs may be substantially affected by the drainage pattern of the sampling area.

Multi-spectral remote sensing data have now been acquired for the Lynn Lake region, and will be used to search for metal-induced stress in vegetation associated with blind mineralization along the entire length of the Agassiz Metallotect.

Basal till studies initiated in 1985, and subsequently adopted by exploration companies active in northern Manitoba, encountered anomalous arsenic and gold values in the Ruttan region in till deposited on the lee side of large outcrops. Several factors indicate a principal source associated with the Vol fault.

Till sampling east of Great Island on the Seal River confirmed earlier reported high arsenic values, some of which were significantly above regional background values. These results, together with previously identified lake sediment geochemical anomalies and recent accounts of extensive arsenopyrite traced to bedrock northwest of Great Island, collectively indicate a hitherto unrecognized metallogenic signature and high gold potential for the greenstones of this region.

U-Pb zircon ages from porphyritic granite and monzocharnockite in the Chipewyan Batholith are coeval, agreeing with those from the Saskatchewan extensions of the pluton, and appear to indicate emplacement of magma at 1855 Ma* into slightly older (1875-1880 Ma) crustal rocks. Although intense deformation appears to have waned by 1832 Ma, the largely post-tectonic dyke on Reindeer Lake giving this age shows evidence of subsequent deformation and recrystallization.

## Flin Flon — Snow Lake District

Detailed mapping, sampling and mineral deposit investigations focussed on the Vamp, Tartan Lake, Baker Patton, Neso Lake, Twin Lakes and Fay Lake deposits. At Tartan Lake, the recognition of a distinctive zonation in the shear zones, and pattern of alteration, will assist the search for extensions to the shear zones containing the main mineralization. Preliminary geological maps of volcanogenic sulphide mineralization were prepared for the Baker Patton and Fay Lake occurrences.

In the Snow Lake region, the bulk of data acquisition for preparation of 1:50 000 and 1:20 000 scale metallogenic maps has been completed. Further evidence was obtained supporting the concept that polymetallic quartz veins, within or close to mafic volcanic rocks containing Cu-Zn (copper-zinc) massive sulphide deposits, represent a genetically associated 'leakage' or 'sweat-out' alteration phenomenon.

**U-Pb is uranium-lead.*

**Ma is mega annum.*

Industrial minerals investigations focussed on garnet and sillimanite deposits at Star Lake, talc at Iskwasum Lake, dolomite south of the exposed Flin Flon and Snow Lake greenstone district, and kaolin associated with the Paleozoic unconformity.

Mineral deposit studies in the Kisseynew terrain entailed detailed mapping of selected mineral occurrences at Puffy, Walton and Evans Lakes as well as a reconnaissance north of Nokomis Lake and south of Walton Lake. It is now apparent that quartzofeldspathic gneisses may occur locally within the so-called Nokomis greywacke sequence. However, the structural, as opposed to the stratigraphic, controls on this more complex configuration have yet to be resolved.

Mapping at a scale of 1:20 000 in the Flin Flon region extended coverage into the Athapapuskow Lake area and confirmed the principal structural control by major block-bounding faults of several different ages, as well as the difficulty of correlating stratigraphy and mineralized zones between fault blocks.

Reconnaissance mapping of the Tartan Lake and Lac Aimee area established the late emplacement age of the gabbro complex which hosts the sulphide and gold mineralization.

Continuing work in the Kisseynew Lake area provided further confirmation that a single mineralized metallotect is an oversimplified concept, since the paragneissic sequences contain numerous amphibolite layers at different levels within the intensely deformed migmatitic complex. A unit of metamorphosed feldspar-phyric basalt on Weasel Bay, and a metamorphically armoured norite intrusion south of Imperial Lake, may represent northern extensions of the Amisk Group and Boundary Intrusions, respectively.

On Kississing Lake, intensive documentation of shoreline exposures seems to confirm the existence, at a regional scale, of the three principal lithologic associations defined by earlier workers (garnet-biotite-graphite gneiss, amphibolites, and quartzofeldspathic gneiss). However, in detail this simplistic grouping appears invalid and numerous instances occur where units appear out of sequence and with little along-strike continuity. Preliminary interpretations of structural history indicate at least three folding events (recumbent, isoclinal, cross-folding), the latter with associated brittle deformation. Mineral occurrences/conductors appear associated with the amphibolite sequence, especially in areas of considerable deformation.

Geological mapping at a scale of 1:15 840 in the Chisel-Morgan Lakes area delineated several major fault structures, and identified more than one age of synvolcanic quartz-phyric tonalite displaying Fe-Mg (iron-magnesium) alteration networks. A direct, though tentative, corollary to this is the inference that associated hydrothermal activity (and hence mineralizing events), may have spanned a considerable time interval during the evolution of the Flin Flon-Snow Lake greenstone belt. Consequently, mineral deposits may occur at several, rather than a single, stratigraphic level in the volcanic sequence.

Close to 400 samples collected from granitic intrusives in the Flin Flon belt are being analyzed at the University of Manitoba as the initial step of a longer-term program to categorize geochemically the felsic intrusions of this region and evaluate their metallogenic potential.

Ten additional holes were drilled south of Athapapuskow Lake as a continuation of the sub-Paleozoic compilation in the Project Cormorant area.

## Southeast Manitoba District

An additional 30 mineral occurrences were examined in the Rice Lake region, bringing documentation in this region near to completion. Particular attention was given to gold associated with epigenetic sulphide mineralization at the 'Tut' occurrence, gold-bearing quartz veins in a two-kilometre long stratigraphic unit at Lily Lake, and gold within arkosic rocks of the Edmunds Lake Formation.

Samples from the Dumbarton Mine/Maskwa West pit, the Wards occurrence, New Manitoba Mine, Hititrite and Mayville occurrences, English Lake and the Bird River Complex, returned only sub-economic and/or marginally detectable Pt (platinum) and Pd (paladium) values, as did 50 samples from the Neepawa mafic-ultramafic complex.

There was continued evaluation of potential sites for dimension stone in southeast Manitoba, as well as collection of additional samples of kaolin on Black Island using a solid stem auger. Ground truthing of peat bogs near Grindstone Point was conducted in co-operation with the Manitoba Centre for Remote Sensing and the University of Manitoba Department of Botany. This is part of a continuing program to evaluate the use of remote sensing as a means of conducting a rapid and economic regional inventory of sphagnum peat bogs.

Detailed mapping near Stormy Lake and the Manigotagan River refined the structure and stratigraphy of the Wadhope-Gunnar anticlinorium, as well as the transition from volcanism to sedimentation in the Rice Lake Group. Several new factors of economic significance were unveiled, including definition of subaerial volcanics, location of volcanic vents and a structural control of mineralization in gabbroic rocks.

Backhoe sampling in the Manigotagan area confirmed both the presence of trace gold in reworked littoral glacial sands, and a potential for placer deposits.

An evaluation of geophysical and subsurface drill hole information has led to an enhanced interpretation of the Precambrian geology beneath Phanerozoic cover rocks in the Whitemouth and Black Island areas.

## Thompson District

In north-central Manitoba, the industrial minerals evaluation focussed on marble in the Thompson and Pipe open pits, cordierite in the Nelson House region and alteration minerals at the Ruttan Mine. Samples were also collected from the Manasan Quarry which may have potential as a source for lump silica.

Mapping at a scale of 1:20 000 at Cross Lake extended eastwards to encompass supracrustal sequences at Butterfly Lake as well as all lithologies in the Jenpeg forebay, and on Playgreen and Kiskittogisu Lakes. Geologically the latter area is similar to the Molson Lake batholithic domain, comprising an older suite of large batholith complexes with an extended tectonic history. The batholiths predate the Cross Lake supracrustal sequence.

Detailed sampling of anorthosites and the associated magnetite/ilmenite deposit on Pipestone Lake was extended westwards to include the 'West Channel' anorthosite between the Minago River and Kiskitto Lake. Although no chromitite seams were discovered in this anorthosite, numerous samples were collected for analysis. The initial appraisal suggests mineralogical and textural similarities with the Fiskenaesset complex in Greenland, a generally high anorthite content, as well as some potential for building stone.

In Thompson, the recent development of INCO's new open pit mine facilitated detailed documentation of a complete reference section of meta-sedimentary and mafic-ultramafic rocks associated with the ore zone, which are only sporadically and incompletely exposed elsewhere. Several factors appear to support an originally Archean age for ultramafics exposed in the pit.

Geochemical, rare earth, and trace element analyses are being undertaken, with co-operation from the University of Manitoba, on mafic and ultramafic rocks along the Thompson belt. Rubidium-strontium determinations were also initiated on felsic intrusions and late deformation zones (pseudotachylite). Together with detailed and regional structural studies funded by the GSC, and the U-Pb geochronology program, these projects represent a concerted attempt to come to grips with the geology of the Churchill-Superior boundary zone, to understand the paragenesis of the nickel deposits, and to evaluate the potential for other types of mineralization.

U-Pb geochronology in the Pikwitonei-Cross Lake region consistently revealed the presence of two distinct events at a number of localities throughout the Pikwitonei subprovince, although minor differences in these ages were also evident. The older ages all fall within a limited range, i.e., 2719 Ma (Sipiwesk), 2690 Ma (Natawahunan) and 2695 Ma (Cauchon). However, the younger set encompasses a time span of 44 Ma with the youngest age occurring at Cauchon Lake, where post-granulite pegmatite has been dated at 2629 Ma.

Ages on a Cross Lake-Molson Lake dyke (1884 Ma), a Cuthbert Lake ultramafic dyke (1883 Ma) and the Fox River Sill itself (1884 Ma) suggest that these intrusions are coeval and possibly comagmatic, recording an intrusive event that took place after extrusion of the Lynn Lake arc volcanics (1910 Ma) and slightly prior to intrusions along the Churchill River magmatic zone, and the contemporaneous Ruttan volcanics (1878 Ma).

## Northwest Superior Province: Gods Lake — Island Lake Region

A reconnaissance of the Ponask Lake region encountered widespread mylonites, amphibolites and quartz diorite, but, with the exception of some small mafic intrusions, no economically significant mafic or ultramafic complexes were encountered. Consequently, there appears to be little potential for economic titanium, vanadium, chromium or platinum mineralization in the area.

The continuing evaluation of rare-element pegmatites in the province by the University of Manitoba has brought to light extensive and possibly economically significant occurrences of petalite in pegmatitic leucogranite at Red Sucker Lake. The associated highly fractionated geochemical anomaly is not only large, but compares favourably with that developed over the Bernic Lake pegmatite in southeast Manitoba.

## Southern Manitoba

Documentation of industrial minerals in the Duck Mountain area was undertaken to provide background data for an industrial minerals potential map, the first of several intended for southern Manitoba.

Four projects were conducted as part of the stratigraphic mapping, and stratigraphic and industrial minerals drilling program. Sampling and core drilling of the Stonewall Formation were undertaken to provide accurate stratigraphic control on the location of the Silurian/Ordovician boundary in Manitoba. Additional drilling was undertaken to obtain a detailed profile of a Winnipegosis reef and to establish a model for reef development.

Outcrop mapping was completed in the Clearwater-Cormorant-Moose Lake area as part of an extensive program, also involving 'scout' drilling, designed to provide information on the lower Paleozoic sequences, as well as additional control on the distribution of units in the Precambrian basement inferred from gradiometer surveys conducted by the Geological Survey of Canada (GSC).

Eight Precambrian sites in southeastern Manitoba were cored as part of a project to evaluate the quality of selected granitic rocks as ornamental/dimension stone.

## Geological Survey of Canada

A comprehensive array of programs was also delivered by the GSC as the federal contribution to the MDA. These included several new aeromagnetic gradiometer surveys of the Elbow Lak, Hargrave River, and Moose Lake regions near Flin Flon, and Rice Lake (NTS 52M/4 and 52L/13NE) and Whitemouth (52E/6,11) areas in southeast Manitoba.

Total field and vertical gradient maps at a scale of 1:50 000 were released for the Laurie Lake-Lynn Lake and Issett Lake-Pemichigamau Lake areas on April 29, 1986.

Regional lake sediment geochemical surveys were extended to the Red Sucker Lake and Island Lake region (NTS areas 53K, 53L, 53M (S 1/2) and 53 E (N 1/2)), and regional till sampling and surficial mapping to NTS (National Topographic System) areas 63N, 63-O (W 1/2), 64B (S 1/2) and the north half of 63K near Flin Flon. The Terrain Sciences Division is also continuing research into the influence of glacial Lake Agassiz clays on the geochemistry of recent lake sediments, including deep coring of several lakes to assess vertical geochemical variations and possible vertical pathways for metal migration.

Detailed geological mapping is continuing near Laurie Lake and the Fox Mine, as well as investigations which concentrate on examining alteration zones associated with volcanogenic massive sulphide deposits in the Lynn Lake, Flin Flon and Snow Lake areas.

U-Pb ages have been determined for several of the key units in the southern Churchill Province and others are near completion.

Mineral investigations in the Flin Flon area involve the study of gold metallogeny, the metallogeny of mafic and ultramafic rocks and the study of deep footwall alteration zones below massive sulphide deposits.

A Master's degree will be completed at Carleton University on the pervasive silicification of rocks deep in the footwall to the Chisel Mine. Gold studies involved mapping of areas containing gold deposits in the Elbow Lake and Snow Lake regions, as well as around Phantom Lake in Saskatchewan.

A University of Manitoba study, characterizing the mafic and ultra-mafic intrusions in the Flin Flon-Snow Lake belt, concentrated this year on the Reed Lake Pluton.

An initial compilation of all available geological and geophysical data is being undertaken by Taiga Consultants Ltd.

The Namew Lake Platinum Group Element (PGE)-nickel deposit was also investigated.

In the Bissett area, the GSC continued regional structural studies in the area centred on the San Antonio Gold Mine. The University of Manitoba continued its work on the mine-scale structures controlling the gold mineralization.

On the Chrome Property, in the Bird River layered intrusion, mapping of the chromite layers continued at a 1:100 scale.

Farther south, several students from the University of Manitoba engaged in studies on the Falcon Lake Stock, including a thesis on the internal structure of the plug, as well as studies of the petrography and gold mineralization, the latter centered on the Sunbeam-Kirkland Mine.

In the Thompson region the U-Pb geochronology program under contract to the Royal Ontario Museum continued, with the area of interest extended to Cross Lake, where mapping by provincial geologists has revealed well exposed rock types amenable to age dating.

A University of Toronto doctoral study investigated the structural setting of the Thompson Belt based on a detailed transect from the Pikwitonei granulite terrain to the Churchill-Superior boundary.

Under the Mineral Investigations sub-program, the structure and related geology of the nickel deposits at the Thompson Mine constitutes a Ph.D. study at the University of New Brunswick.

The Terrain Sciences Division supervised a shallow seismic survey in the Thompson area along a line towards Gillam, the objective being to define thick deposits of glacial material that can be drilled during the 1987/88 season, in the hope of characterizing the glaciation that has affected much of northern Manitoba.

Several 1:250 000 scale Quaternary maps, covering a large portion of the Superior Province in Manitoba, are being compiled from air photo interpretations, together with selected ground truthing.

## Meeting with Industry

The results of the 1986 field programs were reported at the Annual Meeting with Industry in Winnipeg on November 20 and 21. The meeting was attended by 267 delegates. A *Report of Field Activities*, 12 *Preliminary Maps*, two synoptic compilation maps of the Lynn Lake district, a *Bibliography of Manitoba Geology*, and several other open file reports were released at the meeting, along with the talks and displays by provincial and federal geologists and staff from the Department of Geological Sciences, University of Manitoba.

## Mineral Exploration Liaison Committee

The Mineral Exploration Liaison Committee was expanded to include representatives from all three major northern mining districts, Winnipeg-based exploration companies, the Winnipeg section of the Prospectors and Developers Association, and the Manitoba-Saskatchewan Prospectors Association.

The committee met November 19, 1986 to review the previous summer's field work and to discuss the outline of programs to be delivered in 1987. Several industry recommendations were subsequently incorporated into the workplan for 1987-88.

## Applied Geoscience Research

Applied geoscience research (AGR) efforts were constrained to six projects, five being with the University of Manitoba, due to reduced funding levels. The Geological Survey of Canada sponsored 12 AGR projects, six through the University of Manitoba and six with universities and agencies in other provinces.

## Analytical and Geochemical Laboratory

The Analytical and Geochemical Laboratory supported Manitoba prospectors and the branch's geologists involved in mineral deposit studies and mapping, by providing assays, geochemical analyses or complete silicate analysis of their samples. In the 1986-87 fiscal year, the Analytical Laboratory provided 3,471 assay determinations, 17,581 silicate analyses, and 23 spectrographic determinations. The Geochemical Laboratory made 51,252 geochemical determinations.

## Editorial and Cartographic Services

Editorial and Cartographic Services supply advisory and technical support in all phases of the preparation of geological reports for the Geological Services and Mines Branches, and for the Petroleum Division. The various reports published or in press during the year ending March 31, 1986 are listed in Table 13.

Granville Lake NTS 64C (1:250 000) map sheet was the second map in the Bedrock Compilation Map Series. The 1986 Report of Field Activities contained 55 papers on various aspects of Manitoba's geology and mineral resources. A major project, printer-ready at the end of the fiscal year, was the drafting of the Geological Highway May of Manitoba (with interpretative descriptions of many aspects of Manitoba's geology, prepared by the Manitoba Museum of Man and Nature, on the reverse side). The project was proposed by the Winnipeg Section of the Geological Association of Canada.

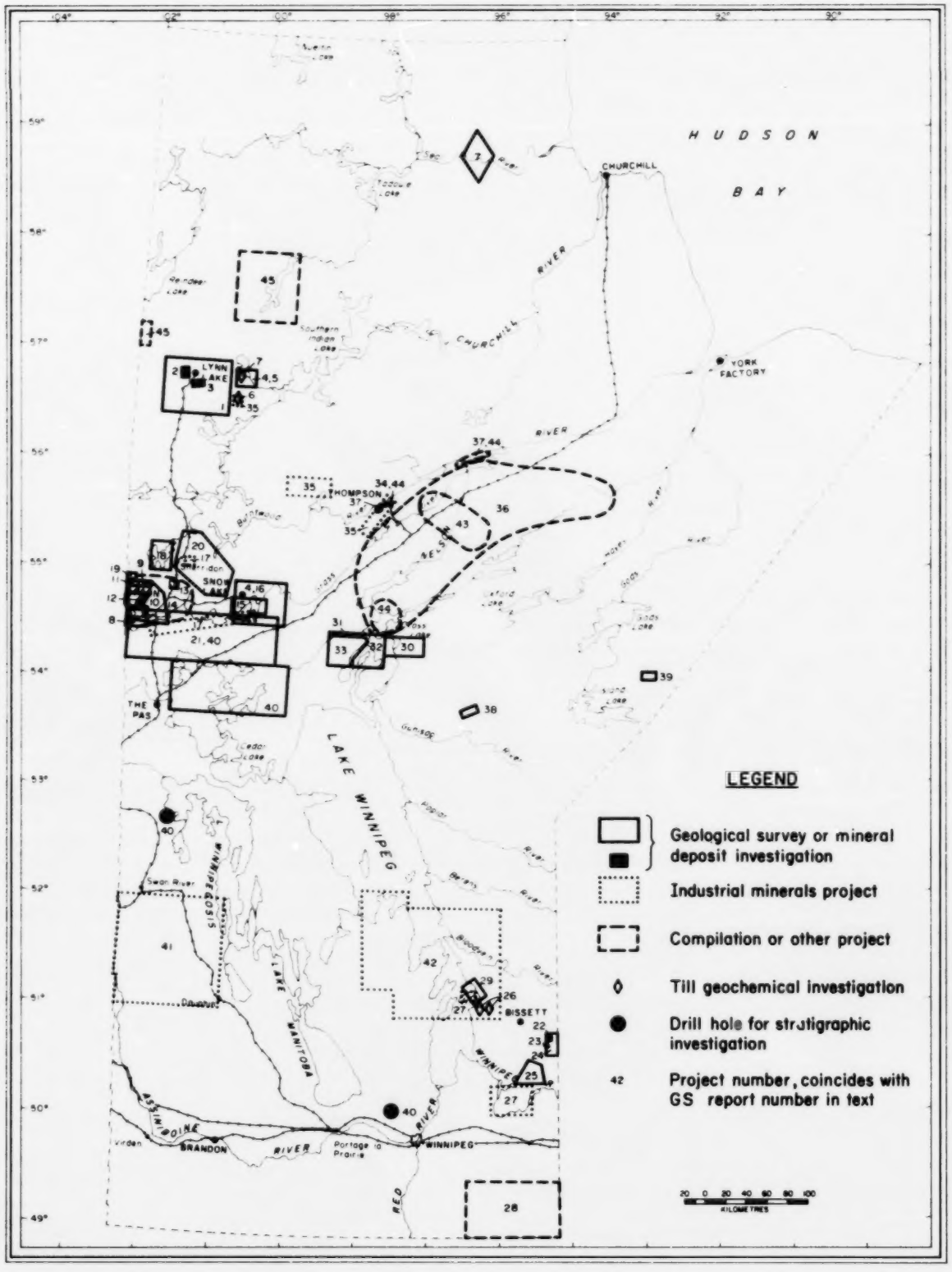
In addition, displays and other materials were prepared for various presentations by staff members.

## Rock Preparation Laboratory

During the year ending March 31, 1987, the Rock Preparation Laboratory completed 2,717 thin sections, 472 stained slabs and 764 polished slabs. The laboratory also prepared 2,264 samples for chemical analysis.

The Rock Preparation Laboratory maintained a Precambrian rock and two petroleum core warehouses. Support was also provided to 30 requests from the petroleum industry to review core.

The Rock Preparation Laboratory was also involved in a summertime core hole program in which 40 holes were drilled for a total of 1153.95 metres. Of these, eight were for building stone, seven were for stratigraphic interpretation, 10 in Project Cormorant area, and 15 for industrial mineral evaluation on Black Island.




*Location of Field Projects, 1986.*

## Location of Field Projects, 1986

### Map Legend

### Lynn Lake District

GS-1 — Mineral deposit studies — Lynn Lake area
by D.A. Baldwin

GS-2 — Geological investigations — Sheila Lake-Margaret Lake area
by K. Ferreira

GS-3 — Geological investigations — Foster Lake-Wasekwan Lake area
by K. Ferreira

GS-4 — Vegetation geochemistry — Lynn Lake and Snow Lake areas
by M.A.F. Fedikow

GS-5 — The Agassiz Metallotect — Spider Lake area
by M.A.F. Fedikow

GS-6 — Till geochemistry east of the Ruttan Mine
by E. Nielsen

GS-7 — Till geochemistry — northern Manitoba
by E. Nielsen

### Flin Flon District

GS-8 — Schist Lake Geology (Athapapuskow Project)
by E.C. Syme

GS-9 — Geological investigations — Tartan Lake-Lac Aimee area
by H.P. Gilbert

GS-10 — Mineral occurrences studies — Flin Flon area
by D. Parbery

GS-11 — Geology Tartan Lake gold deposit
by S. Peloquin, B. Tannahill and G.H. Gale

GS-12 — Geology Baker Patton area
by B. Tannahill and G.H. Gale

GS-13 — Vamp Lake sulphide deposit
by R.S. Wadein and P. Laznicka

GS-14 — Geochemistry granitic rocks — Flin Flon-Snow Lake area
by N. Halden and G.S. Clark

GS-15 — Geology Chisel-Morgan Lakes
by A.H. Bailes

GS-16 — Mineral deposit studies — Snow Lake area
by M.A.F. Fedikow, C.T. Roney, G.J. Schmidt and T.J. Robbie

GS-17 — Industrial mineral occurrences — Flin Flon-Snow Lake area
by W.R. Gunter and P.H. Yamada

GS-18 — Project: Kississing Lake Geology
by D.C.P. Schledewitz and G. Trembath

GS-19 — Project: Geological reconnaissance of Kisseynew Lake west
by W.D. McRitchie

GS-20 — Mineral investigations — Kisseynew gneiss terrain
by G. Ostry

GS-21 — Project Cormorant — sub-Paleozoic investigations
by W.D. McRitchie and I. Hosain

### Southeast Manitoba District

GS-22 — Stratigraphy and structure of the upper Stormy Lake Formation
by D.J. Owens

GS-23 — Stratigraphy of the Manigotagan River Formation
by D.M. Seneshen

GS-24 — Mineral deposit investigations — Rice Lake greenstone belt
by P. Theyer and R. Gaba

GS-25 — Platinum in southeastern Manitoba
by P. Theyer

GS-26 — Quaternary placer gold — Manigotagan area
by E. Nielsen

GS-27 — Industrial minerals — southeast Manitoba
by B.E. Schmidtke

GS-28 — Subsurface Precambrian geology — southeastern Manitoba
by C.R. McGregor

GS-29 — Black Island area — diamond drill and aeromagnetic data
by C.R. McGregor

### Thompson — Cross Lake District

GS-30 — Butterfly Lake Geology area
by M.T. Corkery

GS-31 — Cross Lake-Pipestone Lake anorthosite studies
by H.D.M. Cameron

GS-32 — Kiskittogisu-Playgreen Lakes area
by P.G. Lenton, M.T. Corkery and H.D.M. Cameron

GS-33 — Nelson River anorthosite evaluation
by W.D. McRitchie

GS-34 — Lithological investigations — Thompson open pit
by J.J. Macek

GS-35 — Industrial mineral occurrences — Thompson area
by W.R. Gunter and P.H. Yamada

GS-36 — U-Pb geochronology: Northern Superior Province
by T. Krogh, L. Heaman, N. Machado, D. Davis and W. Weber

GS-37 — Mafic, ultramafic geochemistry — Churchill-Superior boundary zone
by N. Halden

## Northern Superior District

GS-38 — Geological investigations — Ponask Lake
by W. Weber

GS-39 — Mineralized pegmatitic granites — Red Sucker Lake
by L.E. Chackowsky and P. Cerny

## Southeast Manitoba

GS-40 — *Stratigraphic mapping — core hole program*
by H.R. McCabe

GS-41 — Industrial mineral occurrences — Duck Mountain area
by B.E. Schmidtke

GS-42 — Landsat — peat potential in the Grindstone Point area
by B.E. Schmidtke

GS-43 — Metamorphism — Pikwitonei domain
by K. Mezger, S.R. Bohlen and G.N. Hanson

GS-44 — Rb-Sr geochronology — Churchill-Superior boundary zone
by G.S. Clark

GS-45 — U-Pb zircon geochronology — Big Sand Lake area, northern Manitoba
by W.R. Van Schmus and D.C.P. Schledewitz

# Mines

The Mines Branch is responsible for administering matters relating to the operation of mines, smelting and refining operations; recording mineral dispositions; monitoring exploration activities and reviewing assessment reports; the rehabilitation of mining lands; aggregate resource inventory studies; and the implementation of provincial land-use policy concerned with the conservation of aggregate resources. During the year, the branch was also responsible for activities under Sector B of the Canada-Manitoba Mineral Development Agreement.

## Mining Recording

The Mining Recording Section maintains recording offices in Winnipeg and The Pas to administer regulations under The Mines Act governing the disposition of Crown mineral rights other than oil and natural gas. The regulations enable individuals and companies to acquire claims, permits and leases for the right to prospect, develop, and mine Crown minerals.

The mining recorders and their staff process applications for these mineral dispositions; monitor and inspect the activities of disposition holders; collect fees, rents, royalties and refundable performance deposits; maintain records; and deal with enquiries relating to these functions.

During calendar year 1986, a total of 1,488 mining claims were recorded, covering a total area of 301 974 hectares, compared with 136 736 hectares in 1985. Mineral dispositions in good standing at the end of 1986 are given in Table 3. Details of Crown mineral dispositions issued during 1986 are given in Table 4.

Total revenue collected by the section during the fiscal year was $1,668,869, comprising $1,017,606 from dispositions, other fees and rentals; $74,985 from The Mining Claim Lease Tax; and $576,278 from royalties on industrial minerals (see Table 2).

Royalties from industrial minerals production increased ($576,278 in 1986-87 compared with $551,226 in 1985-86) reflecting an increase in activity in the construction industry.

## Aggregate Resources

The Aggregate Resources Section undertakes detailed surficial geological mapping, aggregate resource inventories and prepares quarry mineral land-use recommendations based upon provincial land-use policies. Resource inventory data and resource management proposals are provided to government, municipalities and private sector users.

Economic evaluations of sand and gravel deposits were undertaken by staff geologists in the Rural Municipality of South Norfolk, the Local Government Districts of Park and Reynolds and in the Flin Flon-Cranberry Portage area.

In response to requests from municipal planning districts, data for the protection of quarry mineral resources were compiled and forwarded to resource management geologists. All proposed Crown land transfers, land subdivisions and zoning by-law amendments were reviewed and, where necessary, aggregate information compiled to reduce potential land-use conflicts with mineral extraction. Staff geologists serve on a variety of technical advisory review committees and prepare recommendations for major land use concerns.

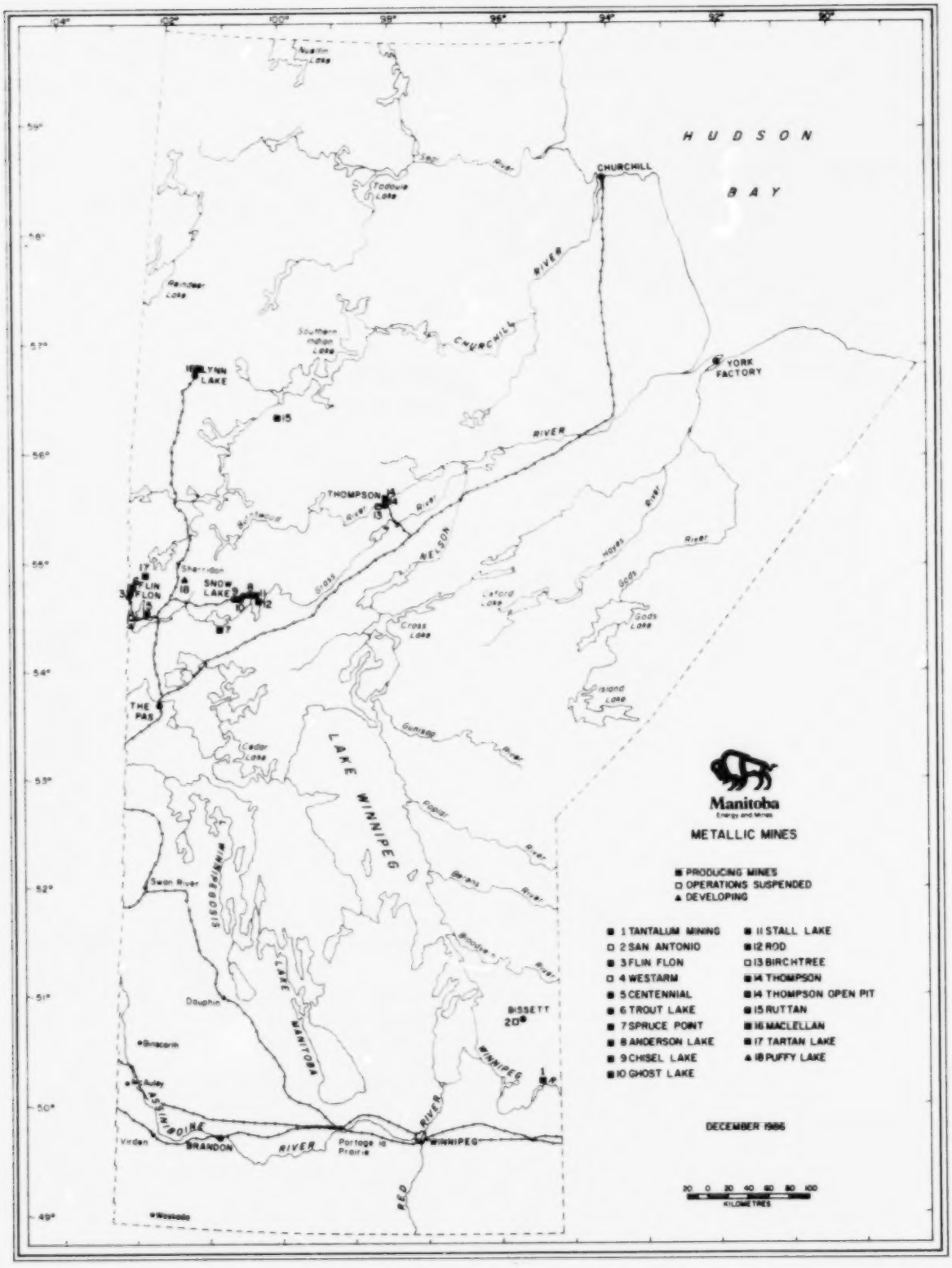
One geological report and one preliminary map were released during the year and are listed in Table 13.

## Exploration Services

The Exploration Services Section, comprised of eight professional and two clerical staff, provides support to mining companies and prospectors engaged in mineral exploration in Manitoba. The section monitors, promotes and documents exploration activity in the province; examines assessment work on mineral dispositions for compliance with the regulations under The Mines Act and disseminates non-confidential data; distributes publications; collects and stores diamond drill core; compiles, disseminates and publishes geological reports and exploration and mineral deposit data; prepares interpretative geophysical maps of active exploration areas; compiles bibliographies and indexes to Manitoba geology; and performs land use, mineral potential studies. The mineral inventory, geological compilation, bibliographic and expanded drill core collection projects are currently being conducted by three term geologists under the Canada-Manitoba Mineral Development Agreement 1984-89.

During the fiscal year, 245 reports of exploration work were received and assessed; 525 files were microfilmed; 72 reports were added to the non-confidential files; 828 files were reproduced for the private mining sector; 1,975 open files were examined by mining industry personnel, 1,705 by staff, and 331 visits were made by mining company personnel. In May, a new master "Index to Non-confidential Assessment Reports," compiled from the CLASS computer file of exploration data, was published as an Open File. Index maps showing the areal extent of non-confidential exploration work were updated.

During the year, 1,539 orders for geological publications and maps were filled, generating $16,543.85 in revenue, up 22 per cent from 1985-86. Publication


HUDSON
BAY
CHURCHILL
YORK FACTORY
THOMPSON
LYNN LAKE
SNOW LAKE
FLIN FLON
THE PAS
LAKE WINNIPEG
BRANDON
WINNIPEG
DAUPHIN
BISSETT
Manitoba
Energy and Mines
METALLIC MINES
PRODUCING MINES
OPERATIONS SUSPENDED
DEVELOPING
1 TANTALUM MINING
2 SAN ANTONIO
3 FLIN FLON
4 WESTARM
5 CENTENNIAL
6 TROUT LAKE
7 SPRUCE POINT
8 ANDERSON LAKE
9 CHISEL LAKE
10 GHOST LAKE
11 STALL LAKE
12 ROD
13 BIRCHTREE
14 THOMPSON
14 THOMPSON OPEN PIT
15 RUTTAN
16 MACLELLAN
17 TARTAN LAKE
18 PUFFY LAKE
DECEMBER 1986
KILOMETRES

release notices for 10 new publications were mailed to the 600 addresses on the mailing list. Forty-four orders for over 2,202 mineral inventory cards and 50 corporation files were filled.

Exploration activity summaries were compiled each month and for the annual Prospectors and Developers Association Convention. Displays depicting the work of the section, the Geological Services Branch and exploration in the province were presented at the Annual Meeting with Industry, the Prospectors and Developers Annual Convention in Toronto, and the Manitoba Schools Career Symposia in Winnipeg, Brandon, Flin Flon and Norway House. For the purposes of promoting mining investment in Manitoba, three members of the section attended the annual Prospectors Convention in Toronto to set up and staff the geological-mining display. Staff members of the section spent 573 person-days in the field, in large part liaising with exploration industry personnel. Two members served on the Mineral Exploration Liaison Committee which was established in 1985 to involve industry in the planning and monitoring of programs under the Mineral Development Agreement.

Core is provided on a voluntary basis by mineral exploration companies and prospectors who, in turn, receive assessment work credits for the transportation costs. The non-confidential core is available for examination, thereby eliminating the need for costly duplication of diamond drilling, and allowing for more productive use of exploration dollars.

Under the diamond drill core acquisition and storage program, a total of 8 126 metres of core was collected in 14 separate field retrievals in northern Manitoba during the year. As of March 31, 1987, the department's drill core inventory was approximately 173 000 metres, stored at four regional core libraries: Lynn Lake, 45 000 metres; The Pas, 74 000 metres; Thompson, 28 000 metres; and Winnipeg, 26 000 metres.

Library improvements and reorganization projects were completed in all buildings, and a major program of selective reduction of core from high density drill projects resulted in the removal of 39 000 metres from the system. A computerized core box labelling system was implemented, and the manual National Topographic System-based data files on all holdings were updated. Preparation of a detailed computer-based index of all holdings was begun. There were 17 inspection visits at the core libraries during the year, consisting of 123 days of use. Publication of a bilingual brochure on the Libraries Program, as well as advertising at the Prospectors and Developers Convention, Annual Meeting with Industry and in the *Report of Field Activities*, have served to increase industry awareness and interest in this service.

Using assessment data, the section's geophysicist conducted geophysical interpretation studies of 212 surveys to update the 1978 publication on the Flin Flon-Snow Lake district. In co-operation with the Geological Services Branch, he prepared an in-depth geophysical interpretation of the Leaf Rapids area. This was part of the Government's Ruttan Task Force mandate to study the mineral discovery potential of the region around this large mining operation, where there are declining reserves.

The Mineral Education Series booklet *Copper and Zinc in Manitoba* was published as well as a bibliography of all provincial and federal geoscientific publications on Manitoba, the latter using an interactive computer data base. Informational pamphlets to assist industry and the public seeking exploration services in the province were updated and printed. A compilation project "Gold Deposits of Manitoba", undertaken jointly by Exploration Services and Geological Services, was in the final editing stage at year end. It will be published in the fall of 1987. A 23-page information handout, which summarizes Manitoba's exploration highlights for the year, was compiled for distribution at the annual Meeting with Industry and at the Prospectors and Developers Association Convention.

The section responsible for examining land-use request clearances in order to avoid future conflicts in areas of high metallic mineral potential, examined 128 such requests and cleared them. Mineral potential, land-use designation and mineral property maps were prepared in response to specific requests and staff served on land-use committees.

## Mining Engineering and Inspection

Visits were made on a regular basis to underground mines in the province to monitor their operation. Special emphasis was placed on two operations which received financial aid from the Government of Manitoba.

A total of 3,131 inspections were made of pits and quarries to monitor compliance with The Mines Act and Regulations. This included both private and Crown operations. Technical advice concerning good mining and rehabilitation practices was provided to the industry and other branches of government.

During the 1986 construction season, Crown aggregate production by 405 permit holders was directed and supervised. In excess of 1.7 million tons of aggregate were removed under these dispositions. Production reports and royalty payments from both Crown permits and Crown leases were subject to field verification.

Input was provided on interdepartmental review committees concerning the development of rehabilitation regulations and Clean Environment Orders dealing with the reclamation of mines.

In response to requests from municipal planning districts, reports were prepared for six municipalities, providing geologic information and recommendations for the protection of local quarry mineral resources. All Crown land transfers, subdivisions, development plans, and zoning by-law amendments, which were proposed during the year, were reviewed. In some cases, technical recommendations were made to minimize potential conflicts with mineral extraction.

Selected outcrops and quarries were evaluated for their aggregate potential, and a report concerning some of these areas was published.

Under the Canada-Manitoba Mineral Development Agreement, 12 research projects on mining and mineral processing were conducted through contracts funded by the Province. Ten of the projects related to new mining technology, six projects were contracted to Manitoba mining companies, two to the University of Manitoba, and three to outside contractors. One project was carried out by Mines Branch personnel. In addition, co-operative assistance was provided to 18 projects funded by the federal government, of which seven related to mine technology and 11 to mineral processing. The provincial expenditure was $508,000.

# The Mining Industry

## *Mineral Production*

The estimated value of mineral production, including metals, industrial minerals and fuels, for the 1986 calendar year was $758.4 million, compared to $861.3 million for 1985, a decrease of 12 per cent. (see Tables 5 and 6.) At $541.7 million (down 5.3 per cent from 1985), metals accounted for 71.4 per cent of the total value of Manitoba's 1986 mineral production. The value of the more significant metals produced during 1986 were nickel $259.6 million (down 9.4 per cent); copper $141.4 million (up 3.0 per cent); zinc $71.4 million (down 12.0 per cent); gold $35.9 million (up 16.2 per cent); silver $8.7 million (down 22.3 per cent).

## *Mining and Processing Operations*

### Metallic Minerals

Mining operations in Manitoba are located in the Flin Flon-Snow Lake area, the Lynn Lake-Leaf Rapids area, and at Thompson and Bernic Lake (see Map 1).

*Hudson Bay Mining and Smelting Co., Limited* operates a number of mines in the Flin Flon-Snow Lake area, concentrators at Flin Flon and Snow Lake, and copper smelting and zinc and cadmium refining facilities at Flin Flon. Besides treating ores from the company's own mines, Manitoba concentrates from the Ruttan mine of Sherritt Gordon Mines Limited and the Trout Lake Joint Venture were also processed at Flin Flon during 1986. The principal products from Hudson Bay's Manitoba facilities are anode copper, refined zinc, refined cadmium, and lead concentrate. At the end of 1986, approximately 1,418 people were employed at the company's mines and processing facilities in Manitoba. An additional 348 people were employed at company operations on the Saskatchewan side of the border.

In the Snow Lake area, the company operates six mines. The 3 500 tonnes per day concentrator at Stall Lake, inaugurated in June 1979, produces copper and zinc concentrates which are shipped to Flin Flon for further processing, and a lead concentrate which is shipped to Trail, B.C. The Chisel Lake, Ghost Lake, Stall Lake, Anderson Lake, Spruce Point, and Rod mines operated continuously.

In the Flin Flon area, mining operations were maintained at the Centennial and Flin Flon mines, and the Trout Lake Mine, operated under a joint venture agreement (Hudson Bay Mining and Smelting Co., Limited 44 per cent, Scandinavian Minerals Syndicate 29 per cent, and Manitoba Mineral Resources Ltd. 27 per cent). During 1985, production was suspended at the Westarm Mine and the suspension continued throughout 1986.

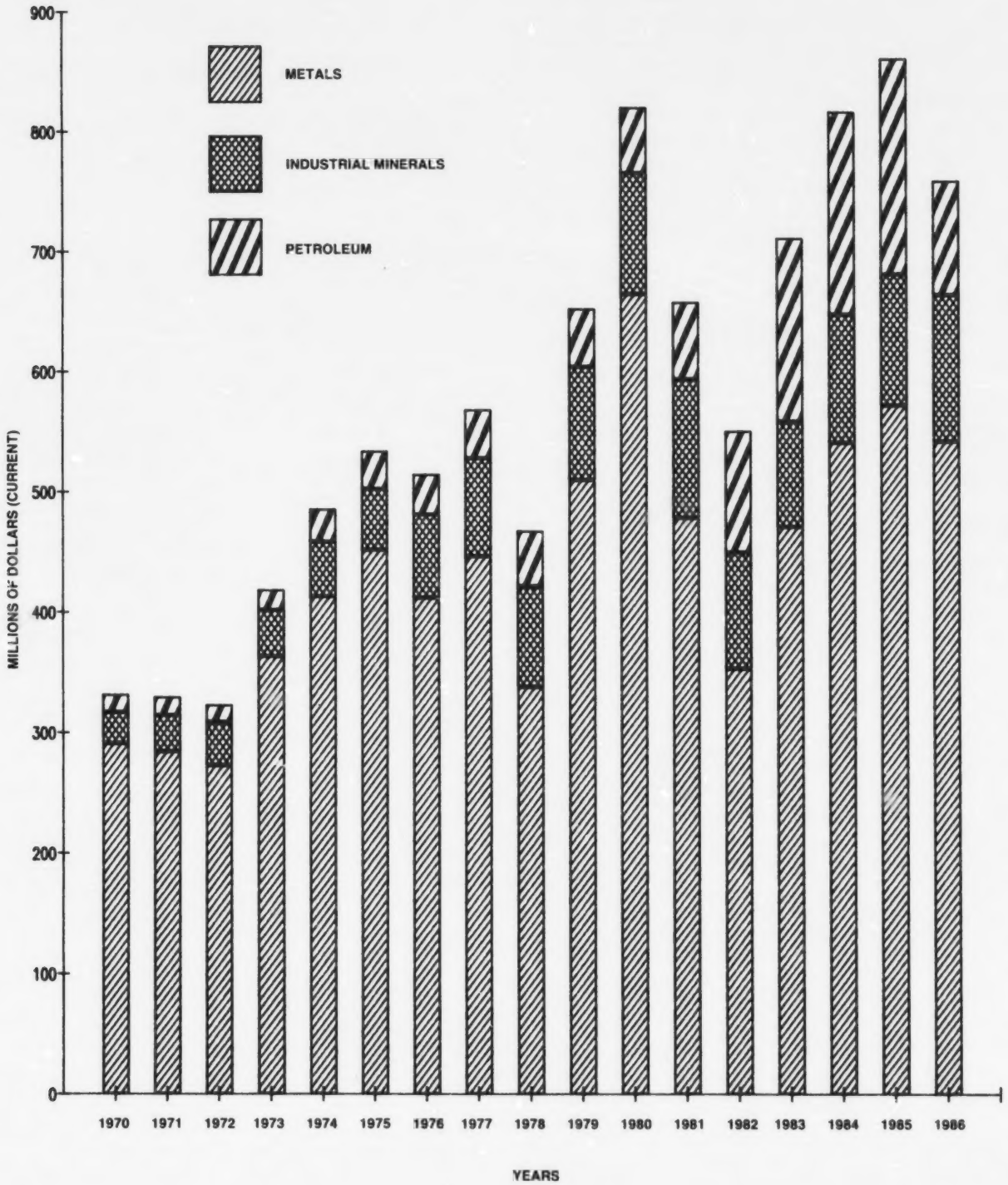
During the year, Inco Limited operated the Thompson underground mine, a concentrator, smelter and nickel refinery at Thompson. The Birchtree Mine continued to be maintained on a standby basis. Production at the Thompson Open Pit achieved a production rate of 4 500 tonnes per day by the end of 1986. The Thompson open pit is mining the crown pillar of the Thompson orebody and replaces the Pipe open pit which ceased production in the fall of 1984. The main product from the Thompson complex is electrolytic nickel. By-products include copper matte, cobalt oxide and pentlandite concentrate. Copper matte is shipped to the company's refinery at Copper Cliff, Ontario, while commercial grade cobalt oxide is shipped to the company's refinery at Clydach, Wales, where refined cobalt oxides and salts are produced. Pentlandite concentrates are sold as feed for Sherritt Gordon's nickel refinery at Fort Saskatchewan, Alberta.

During 1986, Inco's smelting and refining operations at Thompson continued to receive and process nickel concentrates from the company's mine at Shebandowan, Ontario.

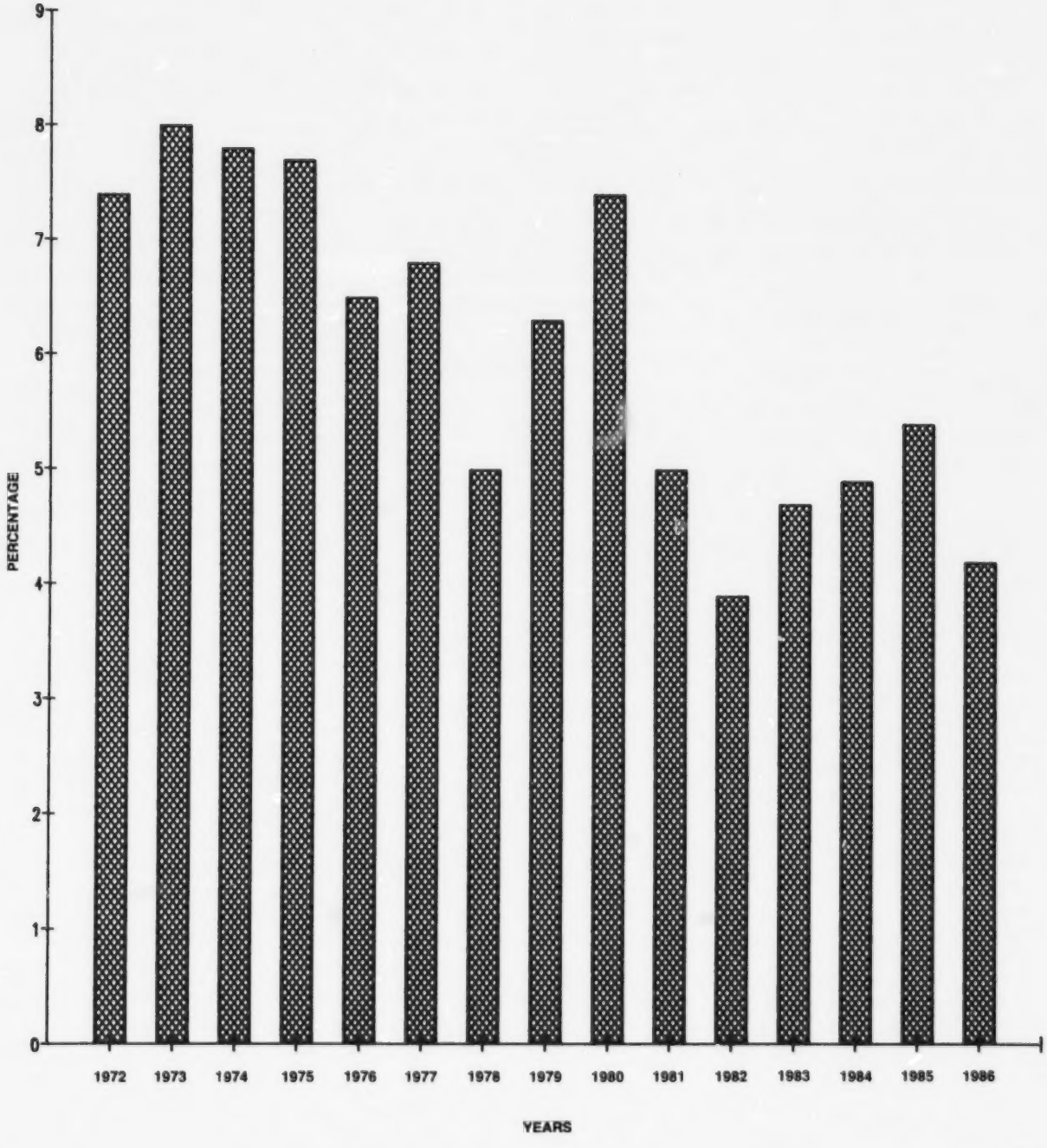
An average of 1,808 persons were employed at Inco's Manitoba operations during 1986.

Sherritt Gordon Mines Limited operated two mines and concentrators in the Lynn Lake-Leaf Rapids area during 1986.

## Value of Mineral Production in Manitoba



## Value of Mineral Production as % of GPP



Production at the Fox Mine, located 48 kilometres southeast of Lynn Lake, which commenced in 1970, ceased at the end of November 1985 as mineable ore reserves were exhausted.

The Ruttan Mine, located 96 kilometres southeast of Lynn Lake, commenced production in 1973 from an open pit. In 1974, development of the underground mine was initiated with a decline and conveyorway. The decline was extended to the 1,400-foot level and a service shaft sunk to the 1,000-foot level. In 1980 this shaft was extended to the 2,230-foot level to permit detailed subsurface drilling of the downward extension of the orebodies.

Further deepening of the shaft to the 3,000-foot level was started in August 1983 and was essentially completed by early 1984. The deepening of the shaft permitted Sherritt to carry out a deep drilling exploration program below the 2,600-foot level, in addition to allowing for development and mining of the Ruttan orebody between the 1,400-foot and 2,600-foot levels. In March 1984, Sherritt's Board of Directors authorized a $28 million development program between the 1,900-foot and 2,600-foot level. Financing of this project was aided by a $10 million loan from the Manitoba Government. Completion of this project has allowed Sherritt Gordon to increase production and employment levels and reduce production costs.

Copper and zinc concentrates produced at the Ruttan mill are trucked to Lynn Lake for rail shipment to Flin Flon, where both zinc and copper concentrates are treated, and Noranda's operations in Quebec, where some of the copper concentrates are processed.

At the end of 1986, Sherritt Gordon had 740 employees on the payroll at its Manitoba operations.

### Tantalum Mining Corporation of Canada Limited (TANCO)

Tantalum mining operations at Tanco's Bernic Lake mine remained suspended during 1986 as accumulated inventories of tantalum concentrates continued to "overhang" the market. Some of the stockpiled concentrate at Bernic Lake was sold in 1986.

In 1984 Tanco, with financial assistance from the federal government, and by modifying the existing tantalum mill, established a pilot plant to produce a high quality, low iron, spodumene concentrate which can be used directly in the manufacture of such items as corning ware and similar competitive end products. As a result of favourable tests, sales have been made to plants in the US, France and Japan. In anticipation of long-term contracts, Tanco is building a new spodumene processing plant at Bernic Lake at a cost of approximately $6.4 million. At the end of 1986, 66 people were employed at Tanco's Bernic Lake operations, of whom 29 were construction workers and 37 permanent staff.

## *Precious Metals*

### MacLellan Mine

In June 1985, Sherritt Gordon's Board of Directors authorized the placing of the MacLellan gold mine into production. The MacLellan Mine (formerly known as the Agassiz deposit) is located eight kilometres north east of Lynn Lake. A decision to bring the MacLellan Mine into production softened the impact of the closure of the Fox Mine by providing alternative employment for the majority of the Fox Mine employees, and helped sustain the community of Lynn Lake, albeit at a reduced level. The MacLellan Mine is being operated by SherrGold Inc., which is 60 per cent owned by Sherritt Gordon and 40 per cent publicly owned. Under an agreement between Sherritt and SherrGold, Sherritt manages the operation of the mine. Although the mine was scheduled to be in full production by the end of 1986, at a planned annual rate of 65,000 ounces of gold and 100,000 ounces of silver, it did not achieve this production and is unlikely to do so until mid-1987.

### San Antonio

In August 1980, Brinco Mining Ltd. and New Forty-Four Mines Limited signed a joint venture agreement to reactivate the San Antonio gold mine in Bissett. The former operation, which initially began production in 1932, had been dormant since 1968 when a fire destroyed the hoistroom. The mine is developed by a shaft and three winzes to a total depth of 1 518 metres.

In 1982, the original joint venture arrangement between Brinco and New Forty-Four Mines Ltd. was renegotiated. Under the new arrangements, Brinco's interest in the mine was increased from 50 per cent to 100 per cent, with New Forty-Four Mines Ltd. retaining a 10 per cent net profits interest, payable after Brinco had recovered its costs associated with development and operation of the mine.

The mine was operated during 1982 and until May 1983 when production was suspended. In June 1983, an exploratory drilling program was carried out by Brinco following which all operations were terminated.

In January 1984, Lathwell Resources Ltd. concluded an agreement with Brinco for the exploration and development of the mine, whereby Lathwell could earn a working interest in the assets of the mine. However, Lathwell failed to meet the requirement of the agreement of having to spend a specified amount during the first year, and thus, lost its option rights to the property.

In November 1985, Canadian Nickel Company Limited, a subsidiary of Inco Limited, began the first phase of an exploration and evaluation program to earn an equity position in the San Antonio Mine.

Whiteshell Resources Ltd. completed exploration and feasibility studies on its properties near Star Lake in the

Whiteshell Park. A detailed development program was submitted for review by the Parks Branch of the Department of Natural Resources. A work permit was issued in February 1984 for a mining operation in the park, with ore to be trucked to a milling site outside the park boundaries. Financing arrangements are being pursued.

## *Industrial Mineral/Structural Materials*

The production and value of industrial minerals and structural materials for 1986 are given in Table 5 in the Statistical Supplement.

A large face-brick plant at Lockport, near Winnipeg, is operated by Red River Brick and Tile Co., using stoneware clay from the Ste. Rose du Lac area, shale from the Pembina Mountain area, and sand from local sources. The plant supplies bricks for the mid-Canada and central-northern United States markets.

Non-swelling bentonite, used mainly in clarification of petroleum and vegetable oils, is mined by Pembina Mountain Clays Inc. near Morden and shipped to the company's plant in Winnipeg for treatment with sulphuric acid to increase its absorbency. Pembina Mountain is the only producer of non-swelling bentonite in Canada.

Gypsum is produced by Domtar Construction Materials Ltd. at Gypsumville for use in the company's wallboard plant in Winnipeg. Westroc Industries Ltd. also produces gypsum at Harcus, near Amaranth for its wallboard plants in Winnipeg and Saskatoon.

Portland Cement production comes from the plant of Inland Cement Limited at Fort Whyte, using local clay and silica sand and limestone quarried at Steep Rock. In addition, portland cement has been produced at the Canada Cement LaFarge Ltd. plant at Fort Whyte using clinker imported from Alberta. Limestone is also quarried north of Mafeking by Inland, to supply the company's cement plant at Regina.

Steel Brothers Canada Ltd. produces lime from kilns in Winnipeg and Faulkner. Limestone and dolomite are quarried at Garson by Gillis Quarries Ltd. for building stone, and crushed rock is produced by numerous operators in the Interlake region and elsewhere. Cold Spring Granite (Canada) Limited and Whitemouth Granite and Stoneworks operate granite quarries in the Lac du Bonnet area primarily for use as building stone. High quality silica sand, quarried from Black Island in Lake Winnipeg by Selkirk Silica Division of Marine Transport Limited, is exported for use in glass-making, as foundry sand, for sand blasting, and as a filtering medium.

Peat moss is produced from sphagnum bogs in southeastern Manitoba and used in horticulture. Fisons Western Corporation operates four bogs near Moss Spur, Julius, and Elma. A fifth bog near Giroux was brought into production in the spring of 1983 by Premier West Peat Moss Ltd. Both companies produce a "value-added" product, combining fertilizer with the peat moss.

## *Mineral Exploration*

Expenditures on mineral exploration in Manitoba for 1986 are estimated at $34.5 million, a decrease of 6 per cent from the estimated $36.7 million in 1985. The 1984 figure was an estimated $30.8 million. Diamond drilling on surface exploration was approximately 175 583 metres compared to 153 716 metres in 1985, an increase of 14 per cent.

The total area of claims recorded in the province during 1986 increased 121 per cent to 301 974 hectares from 136 736 hectares in 1985. The 1984 figure was 201 058 hectares. Mineral dispositions (which include claims, permits and leases) in good standing at the end of the year totalled 1 452 952 hectares compared with 1 349 548 hectares at the end of 1985 (an increase of 8 per cent) and 1 244 549 hectares at the end of 1984. The many dispositions acquired in 1984 were consolidated and explored in 1985. The number of individual exploration projects reported during 1986 increased to 245 from 203 in 1985.

A sustained interest in the gold potential of Manitoba's "greenstone" belts was a major factor in the continued high level of exploration activity. Along with gold, base metals dominated the exploration scene in and around the greenstone belts of Lynn Lake, Flin Flon-Snow Lake, Island Lake, Gods Lake, Fox River and Southeastern Manitoba. There was also minor exploration activity for nickel and pegmatite minerals.

### Base Metals

In the Flin Flon-Snow Lake Belt, exploration activities included geological, geophysical and diamond drilling programs. Companies active in this area were Hudson Bay Exploration and Development Company Limited, Granges Exploration Ltd., Falconbridge Limited, Noranda Exploration Company Limited, Cominco Ltd., Manitoba Mineral Resources Ltd., and a few junior companies and local prospectors.

Extensive drilling was carried out by Hudson Bay Exploration on the Namew Lake nickel-copper deposit 60 kilometres south of Flin Flon. A letter of intent was signed in 1986 between Hudson Bay Mining and Smelting Co., Limited and Outokumpu Mines to establish a joint venture partnership to explore and develop this

deposit. Shaft sinking was started and at the end of 1986, had reached a depth of 1,064 feet, about 300 feet short of the planned final depth.

Extensive surface and underground diamond drilling was carried out by Hudson Bay Exploration under a joint venture agreement with Consolidated Callinan Flin-Flon Mines Ltd. on the copper-zinc deposit which straddles the Saskatchewan-Manitoba border one mile north of Flin Flon.

A new zone of high grade zinc-copper-gold mineralization was discovered at the Trout Lake Mine by Hudson Bay Mining and joint venture partners Granges Exploration Ltd., Manitoba Mineral Resources Ltd. and Outokumpu Mines.

In the Lynn Lake Belt, exploration for base metals included geology, geophysics, geochemistry and diamod drilling. Active companies were Sherritt Gordon Mines Limited, Manitoba Mineral Resources Ltd. and Granges Exploration Ltd.

Base metal exploration projects which consisted of geology, geochemistry, geophysics and diamond drilling were undertaken in the more remote belts of Central Eastern Manitoba by Noranda Exploration Company Limited. Along the "Thompson Nickel Belt", Inco Limited conducted geological and geophysical work as well as diamond drilling on several properties.

## Gold

The greenstone belts of Manitoba, which were host to a number of past gold producers, continued to be the prime focus of exploration interest during 1986.

In the Flin Flon-Snow Lake Belt extensive ore delineation programs, including development of a decline, surface and underground drilling, mapping and bulk sampling were carried out on the Tartan Lake and on the Puffy Lake deposits respectively by Granges Exploration Ltd. in joint venture with Abermin Corporation, and by Pioneer Metals Corporation. Both operators announced plans to place their deposits into production in 1987.

Silver Hart Mines Ltd., through its subsidiary Snow Lake Mines Ltd., carried out a large scale diamond drilling program on the property north of the Snow Lake townsite, where previous work by Gold Fields Mining Corporation and Hudson Bay Exploration had delineated a small but promising gold deposit.

Other companies active for gold in this belt were Hudson Bay Exploration, Noranda Exploration, Esso Resources Canada Limited, Homestake Mineral Development Company Limited, BP Resources Canada Limited, Manitoba Mineral Resources Ltd., Kennco Exploration (Canada) Limited, and a few junior companies and independent prospectors.

In the Lynn Lake Belt, Sherritt Gordon Mines Limited-SherrGold Inc. and Manitoba Mineral Resources Ltd. conducted extensive programs of prospecting, mapping, geochemical sampling, geophysics and diamond drilling throughout the belt.

Extensive ore delineation drilling on the 1985 Farley Lake discovery, 40 kilometres east of Lynn Lake, was carried out by Manitoba Mineral Resources and joint venture partner Hudson Bay Exploration.

During 1986, the gold potential of the Central Eastern Greenstone Belts attracted a number of companies including Westmin Resources Limited, Noranda Exploration, Canadian Nickel Company Limited, Utah Mines Limited, Homestake Mineral Development Company, BP Resources Canada Limited, International Platinum Corporation, Rio Algom Exploration Inc. and a number of junior companies and prospectors.

In the Island Lake area Bighorn Development Corporation carried out diamond drilling, trenching, sampling, prospecting and shaft dewatering to re-evaluate the old Ministik gold mine located on High Rock Island.

The Rice Lake Belt and surrounding areas of Southeastern Manitoba were quite active for gold exploration, with many companies and prospectors participating.

Inco Limited and subsidiary Canadian Nickel Company Limited conducted a regional exploration effort in addition to an extensive underground drilling and sampling program at the San Antonio mine.

Other companies involved in various geological, geophysical and diamond drilling programs in the area included Esso Resources Canada Limited, Falconbridge Limited, Noranda Exploration, Manitoba Mineral Resources Ltd., Abermin Corporation, Kangeld Resources Ltd., Tulsa Resources Limited and other junior companies and local prospectors.

# Petroleum

The Petroleum Division administers provisions under The Mines Act, The Pipe Line Act, and The Gas Storage and Allocation Act relating to exploration, development, production and transportation of crude oil and natural gas. The division also assists the Department of Finance in administering The Oil and Natural Gas Tax Act.

One of the major functions of the division is to develop, recommend, and administer policies and legislative changes to encourage exploration and development of the province's crude oil and natural gas resources in an orderly, safe and efficient manner. It also conducts studies and provides technical assistance to The Oil and Natural Gas Conservation Board on matters relating to salt water disposal, enhanced recovery projects, unitization agreements, and other board responsibilities.

Collection and analysis of petroleum industry statistics, as well as the monitoring of federal-provincial policies, enables the division to evaluate the effects of these policies on the province's petroleum industry. See tables 7-12 inclusive for statistical and financial summaries.

The division releases several reports each year providing the public, industry and government with information on the petroleum industry in Manitoba.

It is comprised of three sections: Administration, Geology, and Engineering and Inspection. Each section has specific responsibilities relating to the overall function of the division.

## Administration

The Administration Section administers regulations under The Mines Act governing the disposition of Crown oil and natural gas rights and the collection of Crown oil and natural gas royalties. These responsibilities include conducting Crown lease and exploration reservation sales; collecting annual rentals; processing renewal and extension applications; and enforcing other provisions under the Petroleum Crown Leasing Regulation and the Petroleum Crown Royalty and Incentives Regulation.

The section also administers the Manitoba Drilling Incentive Program, and the Enhanced Oil Recovery Incentive Program and accumulates and publishes monthly production and disposal/injection data on all active wells in the province.

The section assists the Department of Finance in the collection of taxes from producing freehold mineral rights under The Oil and Natural Gas Tax Act.

In addition to internal administrative functions, the section handles all financial functions of the division, including the collection of registration, license and subscription fees and technical service charges.

## Geology

The Geology Section evaluates geological data and provides consultation to the petroleum industry and the public. It is responsible for the administration of the Petroleum Geophysical Regulation and assists The Oil and Natural Gas Conservation Board in the designation of field and pool boundaries.

The section also prepares reports on Manitoba's petroleum geology and hydrocarbon potential to encourage and assist in the exploration and development of the province's petroleum resource.

## Engineering and Inspection

The Engineering component, located in Winnipeg, administers regulations under The Mines Act relating to petroleum exploration, drilling and production operations (Petroleum Drilling and Production Regulation). As part of this responsibility, it processes drilling license applications as well as applications to recomplete, suspend or abandon wells. Technical support is provided to The Oil and Natural Gas Conservation Board in processing applications relating to well spacing, off-target drilling, production allowables, salt water disposal, pressure maintenance, gas conservation, and unitization.

Through its techical studies of oil and gas reserves, enhanced recovery potential, and the hydrocarbon potential of Manitoba, the Engineering component offers consultation services and information to the petroleum industry and the public.

Administration of The Pipe Line Act and The Gas Storage and Allocation Act are also the responsibility of the Engineering component. In performing its duties, the component encourages the recovery of Manitoba's petroleum resources while minimizing environmental impact.

The Inspection component of the section, with district offices in Virden and Waskada, enforces regulations under The Mines Act relating to geophysical, drilling, production and pipe line operations. Staff license and inspect field facilities, investigate complaints, witness specific operations, and interpret and communicate departmental or regulatory requirements to industry personnel.

The Inspection component also evaluates various techniques for reclaiming soil contaminated by oil or salt water spills.

# Performance of the Petroleum Sector 1977-86

## The Petroleum Industry

### *Crown Oil, Natural Gas Lease Sales*

Two Crown oil and natural gas lease sales were held in 1986. One hundred and three leases, covering 7 904 hectares, were sold for a total of $ 916,268.

In the first lease sale, held on May 7, 1986, the average bonus price per hectare was $139.08, whereas in the October 22, 1986 sale, the average bonus price decreased by 60 per cent to $55.77 per hectare.

The highest price in the May sale was $602.00 per hectare, for a 128 hectare parcel in the Pierson area. The highest price in the October sale was $172.00 per hectare for a 128 hectare parcel, also located in the Pierson area.

One exploration reservation, covering 768 hectares, sold in 1986 for a total of $21,495.

Since Crown oil and gas lease sales resumed in 1979, the Province has received $14,225,086 in revenue from the disposition of Crown oil leases and exploration reservations.

### *Crown Oil and Natural Gas Leases*

As of December 31, 1986, the total area of Crown oil and natural gas rights under disposition was 66 803 hectares. Of this total, 66 035 hectares were held under lease and 768 hectares under exploration reservations.

On December 31, 1982, deeper rights renewal provisions came into effect for pre-1979 leases. Under these provisions, non-productive areas and rights below the producing formation revert to the Crown at the end of the lease term. From January 1, 1983 to December 31, 1986, these regulatory termination provisions resulted in 231 leases, covering 31 546 hectares, being terminated. The cancelled rights again become available for leasing by other parties interested in actively developing them. A lease may be extended for further periods of one year each if a rental penalty is paid and a commitment to a drilling program is made. In 1986, four leases were extended.

### *Revenue to Freehold Mineral Owners*

More than 80 per cent of the mineral rights in southwestern Manitoba are privately owned (freehold), and it is estimated that gross royalties payable to these owners on oil production in 1986 were approximately $10.3 million (before payment of provincial and federal taxes). In addition, there are initial signing bonuses and delay rental payments for new and non-producing leases.

### *Geophysical Activity*

Eight geophysical licenses were issued in 1986. Programs licensed covered approximately 276 kilometres, making 1986 a very poor year for geophysical exploration activity in the province. The cost of these programs was $0.75 million.

In 1986, geophysical programs were carried out in the Whitewater, Oak Lake, Flossie Lake, Niso Creek and Birtle areas.

Table 10 indicates those programs licensed in 1986, by licensee and by geophysical operator.

### *Drilling Activity*

Drilling activity in Manitoba decreased significantly in 1986 due to the collapse in crude oil prices which began early in the year. In 1986, 116 drilling licenses were issued (63 per cent lower than 1985) resulting in 21 different oil companies drilling 135 wells (50 per cent lower than 1985). Ten drilling contractors using 19 drill rigs drilled 118 675 metres of hole. Of the 135 wells drilled in 1986, 91 were classified as development wells, while the remaining 44 were exploratory.

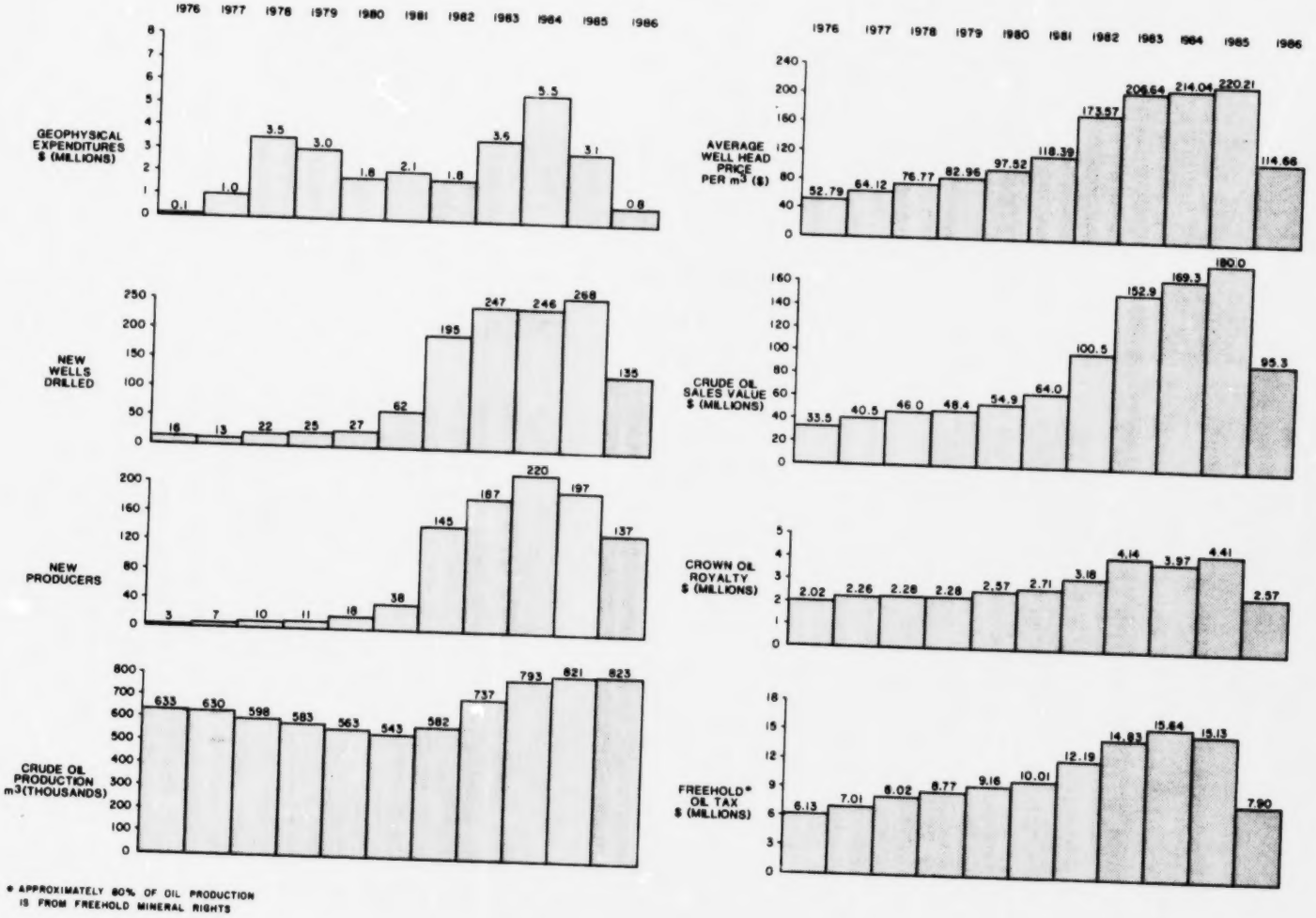
Despite the drop in drilling activity, the success rate of wells drilled continued to be very high. Ninety per cent (122 wells) of the 135 wells drilled were completed as potential oil wells. Ninety-three percent of the 91 development wells drilled and 84 per cent of the 44 exploratory wells were completed as potential oil wells.

The Daly area continued to draw most of the drilling activity (43 per cent), with 41 development wells and 18 exploratory wells being drilled. The Waskada area recorded 25 wells (19 per cent of total drilling activity) while the Virden and Pierson areas accounted for 24 wells drilled.

Other areas of significant interest included the South Pierson and south Virden Fields, where new oil discoveries hold out the potential for more development.

Nineteen of the 135 wells were drilled into the Devonian Formation. Eighteen of these deeper wells were completed as potential oil wells.

# Performance of the Petroleum Sector 1976-1986




* APPROXIMATELY 80% OF OIL PRODUCTION IS FROM FREEHOLD MINERAL RIGHTS

## Production and Markets

Manitoba's annual oil production increased for the fifth consecutive year. Annual oil production in Manitoba reached 823 322 cubic metres (5.2 million barrels) in 1986, representing a slight (.5 per cent) increase over 1985.

During December 1986, the province had 1,367 oil wells producing.

Production from the Daly area continued to increase. In 1985 the Daly area produced 129 422 cubic metres, while in 1986 production increased to 167 050 cubic metres (29 per cent increase). The reason for the increase is due mainly to the very high drilling success rate in the area.

In 1986, 452 800 cubic metres (55 per cent of total production) were classified as "new" oil, or oil produced from wells drilled since 1973.

Of the total amount of Manitoba oil purchased by refiners in 1986, approximately 31 per cent was refined in Ontario, 18 per cent was utilized by refiners in Quebec and 51 per cent went to refineries in the United States.

## Oil Prices

Since December 1985, a world oil glut resulted in a crude oil price collapse which has rippled through all economies that produce or utilize crude oil supplies. Naturally, the higher cost producing countries have seen their petroleum industries virtually shut down as prices have been driven to their lowest level since the 1970s.

In early January 1986, the average price of crude oil produced in Manitoba was $223.40/cubic metres ($35.50 Cdn. per barrel). Average prices then tumbled to a yearly low of $88.30/cubic metre ($14.03 Cdn. per barrel) on July 10, 1986.

By December 31, 1986, the average price of crude oil produced in Manitoba rebounded to $132.47/cubic metre ($21.05 Cdn. per barrel).

In 1986, Manitoba's overall average crude oil price slipped 47 per cent to $114.66/cubic metres ($18.22 Cdn. per barrel) compared with 1985's average of $220.21/cubic metre ($34.99 Cdn. per barrel).

## Value of Production

The total value of oil production during 1986 was $95.3 million, down 47 per cent over 1985. The reason for the lower value was the collapse of crude oil prices.

## Provincial Revenue from Oil Production

Since provincial revenue from crude oil production is either directly or indirectly affected by oil price, there was an overall decrease in direct provincial government revenues. The Manitoba government collected approximately $11.7 million in revenues ($2.6 million in Crown oil royalties, $7.9 million in freehold oil taxes, and $1.2 million in Crown lease sale bonuses, rentals and fees, resulting in a 51 per cent decrease over 1985). These figures do not include provincial revenues in the form of corporate capital tax, sales tax, municipal tax and corporate and individual income tax.

## Municipal Tax Assessments

Oil producers in Manitoba pay a municipal tax on wells and associated production facilities, including oil wells, batteries, salt water disposal wells, salt water disposal plants, water injection wells, suspended wells, flowlines and pipelines.

The municipal tax assessment on these facilities for the calendar year 1986 was approximately $9.02 million, an increase of 5 per cent over the previous year.

Actual revenue from these assessments should amount to approximately $1.8 million for affected municipalities.

## Surface Owners

Companies wishing to explore or develop oil properties in Manitoba must negotiate a surface lease with the individual landowner. In return for this right-of-entry, the landowner normally receives a negotiated cash settlement which includes a first-year bonus payment and subsequent annual rental payments for the duration of the lease.

Where the landowner is renting his land to another party, the oil company seeking right-of-entry must obtain the consent of both the landowner and the occupant. After a lease has been signed, the landowner and occupant then determine what each will receive as their respective share of the compensation paid by the oil company.

Following proclamation of The Surface Rights Act on August 9, 1983, disputes relating to right-of-entry are referred to the Surface Rights Board, whose office is in Winnipeg. The board's principal function is to arbitrate disputes between the petroleum industry and landowners regarding use of land for exploration, development and related operations, and to determine what compensation should be paid to the landowner.

The Minister of Municipal Affairs is responsible for the administration of The Surface Rights Act.

In 1986, an estimated $4.0 million was paid by oil companies to landowners in the form of first-year bonuses ($1.0 million) and annual rental fees ($3.0 million).

The board publishes its own annual report.

## Manitoba Drilling Incentive Program

The Manitoba Drilling Incentive Program provided for reduced Crown oil royalty and freehold oil tax rates on oil produced from new wells. Wells drilled between January 1, 1979, and January 1, 1987 and producing from Crown mineral rights, qualified for a special reduced royalty incentive rate which was 35 per cent of the corresponding base royalty rate charged on "old oil."

New wells producing from freehold mineral rights were eligible for a corresponding incentive freehold oil tax rate under The Oil and Natural Gas Tax Act.

The reduced royalty and tax rates applied to production from a new oil well during its respective incentive period. The incentive period earned for wells producing from provincial Crown mineral rights was called a "royalty incentive period" (RIP) whereas wells producing from freehold mineral rights earned a "production incentive period" (PIP).

As of December 31, 1986, approximately 38 per cent of the 1,592 wells capable of producing oil in the province were operating under an incentive period (20 per cent under RIP and 80 per cent under PIP). Thirty-seven per cent of the 598 incentive wells in the province are located in the Waskada area, while 31 per cent are located in the Daly area.

The Manitoba Drilling Incentive Program was instrumental in attracting oil companies to Manitoba over the past seven years. Since the program was implemented in 1979, the estimated value of the incentive to industry exceeded $14.5 million.

The Drilling Incentive Program expired on December 31, 1986.

## Waskada Gas Plant

During 1986 the Waskada gas plant, now in its third year of production, operated at approximately 33 per cent of capacity (capacity = 85 000 cubic metres/day). The plant, which was built to extract propane, butane and condensate, produced approximately 10 cubic metres of propane, three cubic metres of butane and two cubic metres of condensate daily.

In 1986, 5 488.4 cubic metres of propane, butane and condensate were produced, valued at $502,622. Compared with 1985, volumes in 1986 decreased by 25 per cent. Of the total 5 488.4 cubic metres produced, propane accounted for 65 per cent, butane 19 per cent and condensate 16 per cent.

As of December 31, 1986, the majority of the dry processed gas from the plant was being injected for storage back into underground formations.

## Petroleum Industry Employment

The precipitous fall in crude oil prices not only affected activity levels and revenues, but also employment levels in the industry.

In 1986, direct industry employment decreased to approximately 310, a 15 per cent decrease from 1985 levels. Of this total, approximately 75 person years were attributed to new geophysical and drilling activity, while the remaining 235 person years were associated with ongoing operation and maintenance functions of existing petroleum related facilities.

In addition to direct employment, there are indirect jobs created as a result of petroleum industry activity. For every 10 direct jobs created by the petroleum industry in1986, there were between 10 to 15 indirect jobs created. This resulted in another 310 to 465 person years of indirect employment.

## Industry Expenditure

As a result of the downturn in oil patch activity in Manitoba during 1986, it is estimated that industry spent only $86 million in the province, compared with $139 million in 1985.

The total expenditures can be broken down into seven categories: exploration, development, land, producing facilities, producing costs, royalties and other.

The exploration component, which includes exploratory drilling costs, geophysical and geological work, amounted to approximately $10.5 million.

Development costs include development drilling costs, which accounted for approximately $15.9 million.

Land costs were based on freehold and Crown mineral and surface rights acquisition costs, fees and rentals. The total estimated cost of this component amounted to $5.1 million.

Producing facilities included mainly capital costs associated with field equipment and enhanced recovery schemes. Approximately $4.6 million were spent on this component.

Production costs were valued at $26.8 million and include well operating, flow line, and gas plant costs.

Royalties included freehold production royalties, Crown production royalties and freehold oil taxes. The estimated value of this component was $20.5 million for 1986.

Other costs in total industry expenditure include municipal taxes, right-of-way acquisitions and miscellaneous expenditures totalling approximately $2.8 million.

## Oil Reserves

From 1973 to 1980, remaining established oil reserves in Manitoba declined at a rate of approximately 5 per cent per year due to production and lack of new discoveries.

This trend began to reverse in 1980 as new discoveries were made in the Kirkella area. New discoveries in the Waskada area in 1981 further arrested the decline and reserves increased as a result of additional development in the area in 1982 and 1983. This increase in the province's remaining established reserves followed more than 16 years of decline.

As of December 31, 1986, the province's total remaining established crude oil reserves were estimated to be 8.45 million cubic metres (53 million barrels) down slightly (4.3 per cent) from 1985. The decrease can be attributed mainly to the drop in drilling activity throughout the year as a result of the crude oil price collapse.

## New Petroleum Incentives

To encourage companies to remain interested and active in Manitoba, the provincial government introduced two new petroleum incentive programs in March 1987. A new Drilling Incentive Program (which replaced the previous Manitoba Drilling Incentive Program) effective January 1, 1987, provides successful operators with a Holiday Volume of oil which will be produced royalty or tax free. The Holiday Volume is dependent on oil price, the distance of the well from the nearest well cased for oil and gas production, plus the well's depth, producing formation and any qualifying dry hole credits assigned to the well. Total Holiday Volume for a well is limited to a maximum of 10 000 cubic metres or five years of production, whichever occurs first.

The second program is designed to stimulate Enhanced Oil Recovery projects. Depending on initial oil production rates and water cut for wells in a new project, an operator of a new or enlarged enhanced oil recovery project will be able to produce oil at a reduced royalty or tax rate, up to a maximum of 60 months.

Both programs are in effect from January 1, 1987 to December 31, 1991.

# Oil and Natural Gas Conservation Board

The Oil and Natural Gas Conservation Board was established under provisions of The Mines Act with powers to inquire into all matters relating to the drilling, production, transportation, and distribution of oil and natural gas in Manitoba. The board conducts hearings and may make orders as specified under The Mines Act.

## Board Hearings

In 1986, the board held a hearing dealing with two applications by Chevron Canada Resources Limited. The first application requested that the number of oil wells in part of the Daly Oil Field be increased to one well per eight hectares from the present one well per 16 hectares. The second application requested an approval of a waterflood pressure maintenance scheme for a new area in the same field.

A number of letters of objection to these proposals lead the board to conduct a public hearing on August 7, 1986 in Virden, Manitoba. After reviewing evidence presented at the hearing, the board established a number of conditions for approval, minimizing the impact of the proposals on farmland in the project areas. Chevron's application was approved on January 16, 1987.

## Board Orders

The board also processed other applications and issued the following Board Orders:

### Oil and Natural Gas Conservation Board Orders Issued — 1986

| Board Order Type | Board Order Number | Field/ Pool/Well |
|---|---|---|
| Field Order: | F4-86 | All Fields |
| Pool Order: | P5-86 | All Pools |
| Pressure Maintenance Order: | | |
| | PM-46 | Waskada Mission Canyon 3a C Pool |
| | PM-47 | Waskada Mission Canyon 3b A Pool |
| | PM-48 | Waskada Mission Canyon 3a A Pool |
| | PM-49 | Waskada Mission Canyon 3b B Pool |
| | PM-50 | Waskada Mission Canyon 3a I Pool |
| | PM-51 | Virden Lodgepole A Pool |
| | PM-52 | Waskada Lower Amaranth A Pool |
| Salt Water Disposal Order: | | |
| | 20 SWD | Newscope et al Daly SWD 16-35-9-29 (WPM) |
| | 21 SWD | Beaverhead et al Daly SWD 8-36-9-29 (WPM) |
| | 22 SWD | Newscope et al Tilston SWD A7-8-6-29 (WPM) |
| | 23 SWD | Mann Oil Coulter SWD A7-21-1-27 (WPM) |
| | 24 SWD | Tundra MOGC Virden Prov. SWD 10-29-10-26 (WPM) |
| | 25 SWD | Rideau Daly SWD 10-27-9-29 (WPM) |
| | 26 SWD | Tundra Killucan West Daly Prov. SWD 1-29-10-28 (WPM) |
| | 27 SWD | Tundra Pierson SWD 16-7-3-28 (WPM) |

# Policy, Planning and Project Development

## Energy Policy

The Energy Policy Branch provides research, policy, program development and evaluation for all energy forms to the department's executive and Energy Management Branch. It also advises the Government on emerging energy issues that have implications for the province.

Energy Policy recommends energy development strategies for policy consideration and undertakes supporting economic analysis and evaluation of alternative options. In this regard, it maintains comprehensive information on the current and future energy markets within the province and in other jurisdictions.

The branch is responsible for the evaluation of the national natural gas deregulation process as it affects Manitoba. In this matter, the department intervened in the Public Utilities Board inquiry into the cost of natural gas and the gas distribution companies' applications for new rates as a result of deregulation.

The branch assesses specific energy related and resource development projects. Economic and financial analysis of hydro-electric development, energy exports, energy conservation projects and energy-intensive industries was undertaken during the fiscal year. Much of the work was done in support of the Manitoba Energy Authority.

The Energy Policy Branch intervenes in the hearings of extra-provincial regulatory and advisory bodies such as the National Energy Board as required.

Energy consumption in the province in the years 1984 to 1986 is shown in tables 14 and 15.

## Natural Gas

The deregulation of natural gas markets and prices, as it affected Manitoba consumers, was monitored by Energy Policy staff, who helped develop and advance natural gas policies. Staff provided analytical support to departmental executives, who directed activities toward ensuring fair and equitable natural gas pricing in Manitoba. During the year such activities included meeting and holding discussions with other consuming provinces, producing provinces, the federal government, Manitoba distribution utilities, and TransCanada PipeLines Limited.

Manitoba Public Utilities Board held hearings during February and March 1987 to examine natural gas pricing agreements between TransCanada PipeLines Limited and Manitoba utilities, and to investigate whether the proposed prices were excessive and unduly discriminatory. Staff provided research and analytical support for the department at the hearings.

## Mineral Policy

The function of the Mineral Policy branch is to undertake analysis and evaluation of the economic and policy impact of provincial, national and international mineral developments on the provincial mineral industry, and to assist in policy development and implementation. Studies conducted by the branch contribute to effective management of the provincial mineral resources and the maintenance of appropriate and effective mineral and mineral tax policies.

The branch is also responsible for the collection and analysis of provincial mining statistics. This function is carried out both by direct provincial surveys of mine and mill production, and through agreements with the Department of Energy, Mines and Resources Canada and Statistics Canada, by undertaking on behalf of these agencies surveys of Manitoba mining and exploration companies. A survey of exploration companies active in the province is conducted by the branch in December of each year to provide an estimate of exploration expenditures in the current year and a forecast for the forthcoming year.

The branch is responsible for provincial activities under Sector C of the Canada-Manitoba Mineral Development Agreement, Development and Marketing Studies. Studies have focused on the viability of Manitoba's copper-zinc sector and development opportunities for the province's industrial minerals

Staff undertook and participated in various studies pertaining to the ongoing problems facing Manitoba's mining industry and single resource industry communities, particularly Leaf Rapids and Flin Flon. Staff also provided analysis and policy advice for provincial assistance to new investment programs designed to preserve the viability of Manitoba's northern mining communities. The branch also participated in federal/provincial/industry discussions and analysis on mining taxation issues.

## Manitoba Potash Project

Significant progress was made toward the development of a world-scale potash mine in the Russell-Binscarth area of southwestern Manitoba. The deposit delineated in this area represents one of the best undeveloped potash properties in the world.

In April 1986, Manitoba and Canamax Resources Inc. signed a Co-ownership and Development Agreement, designed to bring the Manitoba Potash Project to the stage where a final production decision can be made. Manitoba acquired a 49 per cent interest in the project and became the operator for all marketing, transportation and consortium development activities. Cana-

max retained a 51 per cent interest and is operator for all on-property development activities.

In 1986, a full scale technical and economic feasibility study of the project commenced. A shaft pilot hole was completed in the fall of 1986 at the location of the proposed production shaft location to confirm the geologic and physical characteristics to the potash mining horizon, and design the shafts. Detailed engineering studies were undertaken to refine and finalize the design of underground and surface facilities.

In the area of marketing and consortium development, discussions were held with a number of potential participants in North America and offshore. A Letter of Understanding with the Minerals and Metals Trading Corporation (MMTC) of India, signed in February 1986, provided the basis for detailed discussions.

MMTC is interested in purchasing 500 000 tonnes of potash per year (one quarter of the mine's planned output) and in acquiring a 25 per cent equity interest.

## Special Projects

The Special Projects section provides research and analysis for specific projects identified by senior management. The section undertakes work on a project by project basis, and during the past fiscal year has assisted in developing new energy conservation policy and program initiatives. It has also commenced planning for energy end-use forecasting through computer modelling, and investigated strategies for integrated resource planning in the natural gas and electricity sectors.

# Financial and Administrative Services

The Financial and Administrative Services Division provides a broad range of service functions in support of the activities of the entire department. These support services are mainly in areas of Finance, Personnel, Operations, and Information Systems. The division is also responsible for administrative policy development.

## Financial Services

Financial Services provides a wide range of financial, accounting and budgetary services to the department. These include:

- financial planning and co-ordination of the estimates process
- financial advice to program directors and managers
- expenditure control
- financial reporting
- voucher processing
- disbursement accounting
- revenue accounting
- co-ordination of authority-seeking document submissions.

The major accomplishments in the past year include the computerization of the financial-planning and expenditure forecasting processes in order to improve the timeliness of financial information reports for executive management.

## Personnel and Operations

Personnel and Operations provides centralized human resource and operational support services to the department. These services include:

- position classification
- recruitment and selection
- employee relations
- training and development
- organizational analysis
- payroll and benefits administration
- affirmative action co-ordination
- performance management
- co-ordination of requests for departmental goods and services, including fleet vehicles, office equipment and office accommodations
- records management
- French Language Services co-ordination.

In 1986-87, 44 positions were staffed and reviews were completed on 13 positions resulting in 10 reclassifications. Major accomplishments during the year include the introduction of a departmental conflict of interest policy, and a comprehensive employee orientation program. In an effort to provide management with accurate organizational and personnel-related information, departmental organization charts were computerized and work was done on automating the personnel data base.

## Information Systems

Information Systems provides the department with data processing, word processing and library support services. The services provided include:

- equipment evaluation, acquisition and user education
- computer systems design and implementation
- liaison between department and other government agencies
- policy and standards development
- maintenance and backup to the main word processing equipment
- assistance to divisions with word processing needs
- purchasing services for journals and books
- cataloguing of books and government documents
- reference and inter-library loans to department employees, industry and education institutions.

The major accomplishments of the past year include the upgrading of hardware and software in the Computer Information Centre and improvements to a number of systems, resulting in increased output, and more accurate and timely departmental information.

# Communications and Community Relations Division

The role of the Communications and Community Relations Division is fivefold:

- to provide communications counsel to the Executive Management Committee;
- to inform the public of the department's activities;
- to assist other branches and divisions in their communications tasks;
- to provide communications services to government agencies reporting to the Minister of Energy and Mines; and
- to inform all departmental staff of departmental activities and policies through internal communication.

In its public information role, the division maintains the Energy and Mines Info Centre in Eaton Place. The centre stocks a wide selection of provincial and federal publications, and publications of Manitoba Hydro. The subject matter of the publications distributed by the Info Centre includes the following:

- energy management techniques for homes, businesses, community organizations, and institutions;
- Manitoba's energy resources, including hydroelectricity, oil and natural gas;
- government energy conservation programs.

The Info Centre answers public inquiries received by mail, telephone and visitors to the centre. Between April 1, 1986 and March 31, 1987, the staff responded to 25,285 inquiries, an increase of 82 per cent over the previous year. The centre staffed displays at 32 locations throughout the year — visiting shopping malls, rural fairs, and trade shows. Overall, the centre distributed 68,619 publications.

In fiscal 1986-87, the centre acquired one of the department's Energy Buses, and refitted it for use as a Mobile Information Centre. In 1987-88, the Mobile Information Centre will visit over 40 communities throughout the province.

Other activities of the division include the preparation of news releases, speeches, slide-tape presentations, slide presentations, feature articles, public service announcements, displays, brochures, posters, radio advertisements, print advertisements, and various newsletters.

# Statistical Supplement 1986/87

**Table 1**

## Energy and Mines Expenditure Summary

Year Ended March 31, 1987

| | 000's | | | |
|---|---|---|---|---|
| | | | Variance | Explanation |
| | Actual | Estimate | Inc (Dec) | Number |
| **Administration and Finance** | | | | |
| Minister's Salary | 14.7 | 20.6 | (5.9) | |
| Executive Support | 298.4 | 302.6 | (4.2) | |
| Communications | 184.9 | 192.8 | (7.9) | |
| Financial and Administrative Services | 611.6 | 604.7 | 6.9 | |
| TOTAL | 1,109.6 | 1,120.7 | (11.1) | |
| **Energy Management** | | | | |
| Policy, Planning and Project Development | 1,131.9 | 894.8 | 237.1 | 1 |
| Provincial Energy Programs | 1,227.6 | 1,791.7 | (564.1) | 2 |
| Provincial Audit Programs | 642.9 | 693.8 | (50.9) | |
| Cut Home Energy Costs (CHEC) | 1,525.6 | 1,587.3 | (61.7) | |
| Manitoba Energy Council | 8.5 | 35.0 | (26.5) | 3 |
| Canada/Manitoba ERDA-Hydrogen Study and Aluminum Smelter Transportation Study | 37.6 | —0— | 37.6 | 4 |
| TOTAL | 4,574.1 | 5,002.6 | (428.5) | |
| **Mineral Resources** | | | | |
| Petroleum | 778.3 | 742.7 | 35.6 | |
| Mines | 1,610.8 | 1,624.4 | (13.6) | |
| Geological Services | 2,045.6 | 2,040.0 | 5.6 | |
| Canada/Manitoba Mineral Development Agreement | 1,875.7 | 2,114.7 | (239.0) | 5 |
| TOTAL | 6,310.4 | 6,521.8 | (211.4) | |
| **Expenditures Related to Capital Assets** | | | | |
| Acquisition/Construction of Physical Assets (MDA) | 83.3 | 88.0 | (4.7) | |
| Capital Grants (Provincial Energy Programs) | —0— | 145.0 | (145.0) | 6 |
| TOTAL | 83.3 | 233.0 | (149.7) | |
| TOTAL DEPARTMENT | 12,077.4 | 12,878.1 | (800.7) | |

## Explanation of Major Variances

1. Major increase attributable to costs for legal and consulting services associated with Natural Gas Deregulation.
2. Major decline attributable to the lack of new conservation demonstration and development projects undertaken on the Conservation and Alternative Energy Agreements.
3. Major decreases due to the lack of consulting contracts required by the Manitoba Energy Council.
4. Funding for the study to determine the least-cost transportation route associated with a proposed Manitoba aluminum smelter was transferred from enabling vote — Economic Development Planning Agreement.
5. Major under-expenditure due to contracts under Sector B being deferred to a later date.
6. Major under-expenditure due to capital grants budgeted related to heat pump installation and demonstration under the Conservation and Alternative Energy Agreement. The signing of the agreement was delayed beyond a point whereby projects could not be started and completed.

**Table 1 (Cont'd)**

## Energy and Mines Revenue Statement

For Year Ending March 31, 1987

| | 000's | | | |
|---|---|---|---|---|
| | | | Variance | Explanation |
| | Actual | Estimate | Inc (Dec) | Number |
| Minerals | 1,596.3 | 1,509.3 | 87.0 | |
| Petroleum | 3,452.6 | 3,566.3 | (113.7) | |
| Sundry Revenue | 112.8 | 14.0 | 98.8 | 1 |
| TOTAL | 5,161.7 | 5,089.6 | 72.1 | |
| Government of Canada | 23.1 | —0— | 23.1 | 2 |
| TOTAL FOR DEPARTMENT | 5,184.8 | 5,089.6 | 95.2 | |

1. Sundry revenue increase attributed to Limestone Training and Employment Agency canteen operations not provided in 1986/87 estimates.
2. Revenue was generated under the Economic Development Planning, Enerdemo, and Conservation and Alternative Energy Agreements which was not anticipated at budget preparation.

**Table 2**

## Revenue from Mining and Quarrying

for year ending March 31, 1987

| | 1985/86 | 1986/87 |
|---|---|---|
| Disposition, Fees, Rentals, etc. | $ 1,369,899* | 1,017,606**** |
| Mining Claim Lease Tax | 76,723 | 74,985 |
| Royalties (from industrial mineral production) | 551,226 | 576,278 |
| The Mining Royalty and Tax Act** | — | — |
| The Mining Tax Act*** | 13,738,676 | 35,600,000 (est) |
| TOTAL | $15,736,524 | $37,268,869 |

* *Includes rental arrears in the amount of $255,932.44 for mining claim leases grouped under Order-In-Council 574/57, 1061/57, 1699/57, 1913/57, 224/59 and 1290/61.*

** *Collection of a royalty under The Mining Royalty and Tax Act was discontinued after December 31, 1980. The revenue shown represents re-assessments for the period prior to that date.*

*** *The Metallic Minerals Royalty Act was redesignated The Mining Tax Act effective January 1, 1981. Revenue shown includes re-assessments made under the former Act.*

**** *Includes Mining Recording revenues only.*

Table 3
## Mineral Dispositions in Good Standing
at calendar year end 1983 to 1986

| | 1983 | | 1984 | | 1985 | | 1986 | |
|---|---|---|---|---|---|---|---|---|
| **Mining** | **No.** | **Hectares** | **No.** | **Hectares** | **No.** | **Hectares** | **No.** | **Hectares** |
| Mining Claims | 5,783 | 646 951 | 6,029 | 715 303 | 5,887 | 702 754 | 6,629 | 872 551 |
| Order-in-Council Leases | 4,184 | 119 382 | 4,184 | 119 382 | 4,184 | 119 382 | 4,184 | 119 382 |
| Permits | 6 | 193 288 | 11 | 351 006 | 8 | 279 456 | 15 | 401 282 |
| Explored Area Leases | 38 | 14 372 | 38 | 14 338* | 37 | 14 050 | 37 | 14 007* |
| Production Leases | 27 | 12 649 | 25 | 12 612 | 25 | 12 612 | 25 | 12 612 |
| Miscellaneous Mineral Leases | 1 | 403 | 1 | 403 | 1 | 403 | 1 | 403 |
| Special Permit | — | — | — | — | 1 | 190 022 | — | — |
| **Potash** | | | | | | | | |
| Permits | 1 | 13 480 | 1 | 13 480 | 1 | 13 480 | 1 | 13 480 |
| **Quarrying** | | | | | | | | |
| Leases | 368 | 10 602 | 393 | 11 472 | 403 | 11 676 | 447 | 13 110 |
| Exploration Permits | 9 | 815 | 6 | 742 | 6 | 693 | 6 | 868 |
| Limestone Exploration Permits | — | — | 2 | 228 | 2 | 228 | 2 | 228 |
| **Peat** | | | | | | | | |
| Leases | 18 | 3 037 | 23 | 3 803 | 24 | 3 951 | 30 | 4 152 |
| Exploration Permits | 4 | 631 | 5 | 1 780 | 4 | 841 | 3 | 877 |
| TOTAL | 10,439 | 1 015 610 | 10,718 | 1 244 549 | 10,583 | 1 349 548 | 11,380 | 1 452 952 |

**Area of Lease reduced*

Table 4

## Mineral Dispositions Issued

each calendar year 1983 to 1986

| | 1983 | | 1984 | | 1985 | | 1986 | |
|---|---|---|---|---|---|---|---|---|
| **Mining** | **No.** | **Hectares** | **No.** | **Hectares** | **No.** | **Hectares** | **No.** | **Hectares** |
| Mining Claims | 891 | 173 055 | 1,112 | 201 058 | 783 | 136 736 | 1,488 | 301 974 |
| Permits | 3 | 124 927 | 8 | 226 079 | 3 | 106 420 | 11 | 310 724 |
| Explored Area Leases | — | — | — | — | — | — | — | — |
| Production Leases | — | — | — | — | — | — | — | — |
| Miscellaneous Mineral Leases | — | — | — | — | — | — | — | — |
| Special Permit | — | — | — | — | 1 | 190 022 | — | — |
| **Quarrying** | | | | | | | | |
| Leases | 17 | 299 | 34 | 1 077 | 23 | 516 | 50 | 1 629 |
| Exploration Permits | — | — | — | — | 1 | 128 | 7 | 868 |
| Limestone Exploration Permits | — | — | 2 | 228 | — | — | — | — |
| Casual Permits | 74 | — | 64 | — | 74 | — | 80 | — |
| Permissions to Remove | 569 | — | 508 | — | 612 | — | 613 | — |
| **Peat** | | | | | | | | |
| Leases | 3 | 98 | 5 | 766 | 1 | 148 | 7 | 202 |
| Exploration Permits | — | — | 3 | 1 699 | 2 | 760 | 1 | 117 |

**Table 5**

## Comparison of Manitoba Mineral Production and Value

1985 and 1986

| | 1985 (Jan-Dec) | | | 1986 (Jan-Dec)* | | |
|---|---|---|---|---|---|---|
| | Quantity (Imperial) | Value ($ 000) | Quantity (Metric) | Quantity (Imperial) | Value ($ 000) | Quantity (Metric) |
| **Metals** | (000 lb) | | (000 kg) | (000 lb) | | (000 kg) |
| Cadmium | 401 | 660 | 182 | 254 | 441 | 115 |
| Cobalt | 741 | 11,526 | 336 | 736 | 7,777 | 334 |
| Copper | 152,275 | 137,175 | 69,071 | 152,723 | 141,389 | 69,274 |
| Lead | 1,634 | 427 | 741 | 1,093 | 334 | 496 |
| Nickel | 85,841 | 286,627 | 38,937 | 96,111 | 259,609 | 43,595 |
| Selenium | 104 | 1,025 | 47 | 150 | 1,162 | 68 |
| Tantalum | 86 | 3,045 | 39 | 86 | 2,124 | 39 |
| Tellurium | 15 | 247 | 7 | 7 | 99 | 3 |
| Zinc | 142,615 | 81,120 | 64,689 | 127,299 | 71,369 | 57,742 |
| Other | — | 1,876 | — | — | 2,986 | — |
| **Precious Metals** | (000 tr oz) | | (000 g) | (000 tr oz) | | (000 g) |
| Gold | 70 | 30,118 | 2,162 | 70 | 35,851 | 2,187 |
| Platinum Group | 21 | 6,885 | 666 | 28 | 9,873 | 881 |
| Silver | 1,292 | 11,205 | 40,179 | 1,100 | 8,707 | 34,227 |
| TOTAL METALS | | 571,936 | | | 541,721 | |
| **Industrial Minerals** | (000 ton) | | (000 tonne) | (000 ton) | | (000 tonne) |
| Cement | 378 | 35,725 | 343 | 475 | 46,104 | 431 |
| Clay Products | — | 2,364 | — | — | 2,700 | — |
| Gypsum | 216 | 1,997 | 196 | 179 | 2,146 | 162 |
| Lime | — | 5,866 | — | — | 5,417 | — |
| Peat Moss | 96 | 10,563 | 87 | 80 | 13,808 | 73 |
| Quartz | — | 2,808 | — | — | 2,979 | — |
| Sand/Gravel | 13,475 | 33,949 | 12,224 | 13,448 | 35,100 | 12,200 |
| Stone | 4,580 | 15,787 | 4,155 | 3,821 | 13,100 | 3,466 |
| Sulphur | 2 | 211 | 2 | 3 | 356 | 3 |
| TOTAL INDUSTRIAL MINERALS | | 109,270 | | | | 121,710 |
| **Fuels** | (000 bbl) | | (000 $m^3$) | (000 bbl) | | (000 $m^3$) |
| Petroleum | 5,166 | 180,049 | 821 | 5,191 | 95,000 | 825 |
| GRAND TOTAL | | 861,255 | | | 758,431 | |

**Estimated*

*Source: Manitoba Energy and Mines*

Table 6

## A Comparison of Value of Manitoba Metals, Industrial Minerals, Fuels and Total Mineral Production

From 1973-1986
(Calendar Year)

| | ($ 000) | | | |
|---|---|---|---|---|
| Year | Metals | Industrial Minerals | Fuels | Total |
| 1973 | 363,650 | 38,416 | 17,148 | 419,214 |
| 1974 | 413,530 | 45,556 | 27,169 | 486,255 |
| 1975 | 452,236 | 50,662 | 31,451 | 534,349 |
| 1976 | 412,301 | 69,173 | 33,557 | 515,031 |
| 1977 | 446,691 | 81,597 | 40,428 | 568,716 |
| 1978 | 338,123 | 83,696 | 45,937 | 467,756 |
| 1979 | 510,049 | 94,279 | 48,403 | 652,731 |
| 1980 | 664,809 | 100,814 | 54,968 | 820,591 |
| 1981 | 478,636 | 115,189 | 64,251 | 658,076 |
| 1982 | 353,150 | 96,607 | 101,065 | 550,822 |
| 1983 | 471,077 | 87,360 | 152,892 | 711,329 |
| 1984 | 540,922 | 106,602 | 169,296 | 816,820 |
| 1985 | 571,936 | 109,270 | 180,049 | 861,255 |
| 1986* | 541,721 | 121,710 | 95,000 | 758,431 |

**Estimated*

**Table 7**

# Manitoba Petroleum Statistics

(1977-1986)

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|
| Geophysical Licenses Issued | 2 | 5 | 10 | 11 | 11 | 19 | 14 | 23 | 25 | 8 |
| Geophysical Expenditures ($) | 1,046,220 | 3,451,370 | 2,970,734 | 1,843,438 | 2,116,854 | 1,805,512 | 3,639,692 | 5,547,086 | 3,081,241 | 764,186 |
| Drilling Licenses Issued | 21 | 16 | 27 | 29 | 71 | 201 | 284 | 249 | 313 | 116 |
| New Wells Drilled | 13 | 22 | 25 | 27 | 62 | 195 | 247 | 246 | 268 | 135 |
| Wells on Production | 7 | 10 | 11 | 18 | 38 | 145 | 187 | 220 | 197 | 137 |
| New Wells Abandoned | 2 | 6 | 9 | 9 | 15 | 30 | 24 | 30 | 30 | 11 |
| Metres Drilled | 11 584 | 18 329 | 20 537 | 23 508 | 61 011 | 184 291 | 229 304 | 220 631 | 231 682 | 118 675 |
| Wells Capable of Production (December) | 804 | 808 | 811 | 823 | 853 | 1 002 | 1 160 | 1 350 | 1 505 | 1 592 |
| Wells Producing (December) | 701 | 703 | 705 | 720 | 748 | 869 | 1 041 | 1 209 | 1 366 | 1 367 |
| Abandoned Producers | 7 | 3 | 4 | 5 | 5 | 11 | 13 | 30 | 14 | 52 |
| Other Wells Abandoned | 1 | 2 | 1 | 0 | 3 | 8 | 5 | 0 | 1 | 16 |
| Crude Oil Production ($m^3$)* | 630 466 | 598 354 | 583 377 | 563 482 | 542 695 | 582 283 | 736 934 | 793 286 | 820 702 | 823 322 |
| Water Production ($m^3$) | 4 228 083 | 4 075 178 | 3 946 337 | 4 171 051 | 4 565 210 | 4 581 786 | 5 079 609 | 5 575 632 | 5 864 460 | 6 215 248 |
| Total Fluid Production ($m^3$) | 4 858 549 | 4 673 532 | 4 529 714 | 4 734 533 | 5 107 905 | 5 163 997 | 5 816 543 | 6 368 916 | 6 685 162 | 7 038 570 |
| % Water Cut | 87 | 87 | 87 | 88 | 89 | 89 | 87 | 88 | 88 | 88 |
| Avg. Oil Production ($m^3$ per day) | 1 727 | 1 639 | 1 598 | 1 540 | 1 487 | 1 595 | 2 019 | 2 173 | 2 248 | 2 556 |
| Total Oil Value ($) | 40,457,038 | 45,953,383 | 48,403,314 | 54,958,340 | 64,054,832 | 100,537,270 | 152,349,870 | 169,296,154 | 180,049,438 | 95,336,905 |
| Crown Oil Royalty ($ received) | 2,263,015 | 2,281,355 | 2,280,162 | 2,574,515 | 2,714,733 | 3,175,625 | 4,135,497 | 3,972,225 | 4,412,927 | 2,566,956 |
| Freehold Oil Tax ($ received) | 7,012,188 | 8,017,968 | 8,768,511 | 9,159,426 | 10,005,107 | 12,194,350 | 14,825,318 | 15,639,045 | 15,132,581 | 7,899,154 |
| Average Oil Price per $m^3$ ($) | 64.14 | 76.77 | 82.97 | 97.57 | 118.39 | 173.57 | 206.64 | 214.04 | 220.21 | 114.66 |
| Reservation Sale Bonuses ($) | (last sale held in 1969) | | 40,888 | 820,345 | 611,199 | — | 40,192 | — | — | 20,285 |
| Lease Sale Bonuses ($) | (last sale held in 1971) | | 897,895 | 1,057,530 | 1,074,958 | 1,055,668 | 1,032,885 | 2,181,499 | 4,215,082 | 891,358 |
| Reservation & Lease Rentals and Fees ($) | 10,237 | 10,198 | 49,300 | 133,686 | 191,409 | 235,812 | 274,088 | 281,673 | 306,792 | 281,570 |
| Crown Reservation Area (ha)* | — | — | 4 736 | 16 915 | 22 291 | 20 947 | 14 496 | 1 024 | 1 024 | 768 |
| Crown Lease Area (ha) | 6 759 | 6 759 | 22 559 | 29 519 | 40 806 | 45 752 | 57 462 | 66 053 | 70 449 | 66 803 |
| Total Crown Area Under Disposition (ha) | 6 759 | 6 759 | 27 295 | 46 434 | 63 097 | 66 699 | 71 958 | 67 077 | 71 473 | 67 571 |
| Industry Reported Total Expenditures ($)* | 18,900,000 | 27,900,000 | 31,000,000 | 38,300,000 | 55,200,000 | 82,600,000 | 116,500,000 | 121,600,000 | 138,500,000 | 86,200,000 |

* *Source: Canadian Petroleum Association prior to 1985 (before PIP Grants and excluding income and Federal taxes); Petroleum Division estimate 1985 and 1986.*

*($m^3$) = cubic metres; (ha) = hectares*

Table 8

## 1986 Summary of Crude Oil and Salt Water Production — All Fields

| | | Cum. Prod. Dec. 31/85 $m^3$* | Production 1986 $m^3$ | Total Cum. Prod. $m^3$ | Wells Producing December 1986 |
|---|---|---|---|---|---|
| Daly Field | OIL | 3 824 269.1 | 167 027.7 | 3 991 296.8 | 309 |
| | WATER | 16 861 055.4 | 1 309 952.6 | 18 171 008.0 | |
| Tilston Field | | 97 194.4 | 6 947.3 | 104 141.7 | 17 |
| | | 526 033.0 | 20 339.3 | 546 372.3 | |
| Waskada Field | | 1 002 418.4 | 248 705.4 | 1 251 123.8 | 344 |
| | | 1 326 725.8 | 505 374.2 | 1 832 100.0 | |
| Lulu Lake Field | | 45 907.6 | 3 995.4 | 49 903.0 | 7 |
| | | 176 746.9 | 12 290.1 | 189 037.0 | |
| Virden Field | | 18 234 671.5 | 320 496.0 | 18 555 167.5 | 542 |
| | | 71 209 758.3 | 4 041 201.7 | 75 250 960.0 | |
| Whitewater Field | | 108 890.0 | 19 895.3 | 128 785.3 | 22 |
| | | 123 323.0 | 55 104.5 | 178 427.5 | |
| Pierson Field | | 305 060.9 | 20 957.5 | 326 018.4 | 44 |
| | | 628 527.5 | 54 269.1 | 682 796.6 | |
| Kirkella Field | | 216 432.1 | 8 558.6 | 224 990.7 | 28 |
| | | 1 633 889.1 | 150 146.2 | 1 784 035.3 | |
| Souris Hartney Field | | 130 219.3 | 2 570.7 | 132 790.0 | 7 |
| | | 248 762.8 | 14 902.4 | 263 665.2 | |
| Coulter Field | | 8 484.2 | 750.5 | 9 234.7 | 2 |
| | | 51 439.1 | 4 797.2 | 56 236.3 | |
| South Pierson Field | | 22 508.2 | 6 498.1 | 29 006.3 | 9 |
| | | 67 381.4 | 15 615.4 | 82 996.8 | |
| Other Areas | | 28 792.2 | 4 375.6 | 33 167.8 | 7 |
| | | 174 399.1 | 19 259.5 | 193 658.6 | |
| Undesignated Pools | | — | — | — | — |
| | | 6 350.1 | 247.7 | 6 597.8 | |
| Confidential Wells | | — | 12 543.8 | 12 543.8 | 29 |
| | | — | 11 747.9 | 11 747.9 | |
| PROVINCIAL TOTAL | OIL | 24 024 847.9 | 823 321.9 | 24 848 169.8 | 1 367 |
| | WATER | 93 034 391.5 | 6 215 247.8 | 99 249 639.3 | |

*($m^3$) = cubic metres*

Table 9

## Crude Oil Sales; Transporters' Deliveries

1986

**Producers Disposition**

| Field | Production $m^3$* | Sales $m^3$* | Value of Sales $ |
|---|---|---|---|
| Daly | 167 027.7 | 164 452.7 | 18,452,700 |
| Tilston | 6 947.3 | 7 156.0 | 809,005 |
| Waskada | 248 705.4 | 251 896.9 | 29,837,075 |
| Lulu Lake | 3 995.4 | 4 210.0 | 475,841 |
| Virden | 320 496.0 | 323 341.9 | 37,174,167 |
| Whitewater | 19 895.3 | 22 940.8 | 2,372,905 |
| Pierson | 20 957.5 | 23 249.1 | 2,619,129 |
| Kirkella | 8 558.6 | 9 115.5 | 938,687 |
| Souris Hartney | 2 570.7 | 2 617.6 | 282,566 |
| Coulter | 750.5 | 196.1 | 21,542 |
| South Pierson | 6 498.1 | 4 545.4 | 517,771 |
| Other Areas | 4 375.6 | 17 750.0 | 1,835,517 |
| Confidential Wells | 12 543.8 | — | — |
| TOTAL | 823 321.9 | 831 472.9 | 95,336,905 |

**Transporters' Deliveries To:**

| Province | Location | Company | Volume ($m^3$)* |
|---|---|---|---|
| Ontario: | Corunna | Shell | 164 529.8 |
| | Corunna | Sunoco | 23 462.4 |
| | Nanticoke | Petro-Canada | 3 014.1 |
| | Sarnia | Imperial | 109 439.4 |
| Quebec: | Montreal | Petro-Canada | 3 248.6 |
| | Montreal | Shell | 26 994.7 |
| | Montreal | Sunoco | — |
| | Montreal | Texaco | 145 719.0 |
| **USA:** | | | |
| Illinois | Mokena | Petro-Canada | 1 450.0 |
| | Mokena | Unocal | 154 695.0 |
| Michigan | Marysville | Sunoco | — |
| Minnesota | Clearbrook | Ashland | 5 059.9 |
| | Clearbrook | Koch | 146 314.5 |
| | Clearbrook | Unocal | 660.0 |
| N.Y. | West Seneca | Canpet | 49 673.0 |
| | West Seneca | Dome | 4 147.2 |
| | West Seneca | Imperial | 47 305.9 |
| | West Seneca | Shell | 90 691.3 |

* *($m^3$) = cubic metres*

Table 10
## Summary of 1986 Geophysical Programs

| Geophysical License No. | Licensee | Contractor | Km* Licensed |
|---|---|---|---|
| 265 | Dome Petroleum Ltd. | Century Geophysical Corp. | 9.2 |
| 266 | Venture Seismic Ltd. | Venture Seismic | 119.0 |
| 267 | Saskatchewan Oil & Gas Corp. | Curzon Exploration Ltd. | cancelled |
| 268 | Canadian Superior Oil Ltd. | Sonics Exploration Ltd. | 24.7 |
| 269 | Home Oil Company Ltd. | Century Geophysical Corp. | cancelled |
| 270 | Channel Resources Ltd. | Beaver Geophysical | 8.0 |
| 271 | Chevron Canada Resources Ltd. | Chevron Industries Inc. | 77.0 |
| 272 | Manitoba Oil and Gas Corp. | Century Geophysical Corp. | 37.8 |
| TOTAL | | | 276.0 |

* *(Km) = kilometres*

Table 11
## 1986 Drilling Statistics

| No. of Wells Drilled by Operator | 1986 | 1985 |
|---|---|---|
| Newscope Resources Ltd. | 16 | 54 |
| Andex Oil and Gas Ltd. | 15 | 15 |
| Home Oil Company Ltd. | 13 | 2 |
| Omega Hydrocarbons Ltd. | 13 | 58 |
| Rideau Petroleums Ltd. | 13 | 33 |
| Tundra Oil and Gas | 12 | 17 |
| Beaverhead Resources Ltd. | 10 | 16 |
| Chevron Canada Resources Ltd. | 9 | 3 |
| Voyager Petroleums Ltd. | 8 | 4 |
| Canadian Roxy Petroleum Ltd. | 5 | 7 |
| Manitoba Oil and Gas Corp. | 4 | — |
| Resman Holdings Ltd. | 3 | 13 |
| Bonus Petroleum Corp. | 2 | 3 |
| Peregrine Petroleums Ltd. | 2 | 2 |
| Saskoil Resources Inc. | 2 | 4 |
| Trans-Canada Resources Ltd. | 2 | — |
| Antler River Resources Ltd. | 1 | 2 |
| Brunswick Resources Ltd. | 1 | — |
| Canamax Resources Inc. | 1 | — |
| Dome Petroleum Ltd. | 1 | 2 |
| ICG Resources Ltd. | 1 | — |
| Mead Petroleum and Farms Ltd. | 1 | 6 |
| TOTAL | 135 | |

| No. of Wells Drilled by Contractor | 1986 | 1985 |
|---|---|---|
| Red Arrow Drilling Ltd. | 42 | 87 |
| Crown Drilling Ltd. | 40 | 102 |
| Can Am Drilling Ltd. | 21 | 52 |
| Sedco Drilling Ltd. | 10 | 4 |
| Big Sky Drilling Ltd. | 6 | — |
| Simmons Drilling Ltd. | 5 | — |
| J. Horn Drilling | 4 | 1 |
| Sabre Drilling Ltd. | 3 | 3 |
| Spartan Drilling Ltd. | 3 | 17 |
| Hemsing Drilling Ltd. | 1 | 1 |
| TOTAL | 135 | |

Table 12

## 1986 Annual Oil Production

| By Operator | Vol. ($m^3$)* |
|---|---|
| Chevron Canada Resources Limited | 322 824.2 |
| Omega Hydrocarbons Ltd. | 196 197.2 |
| Newscope Resources Ltd. | 41 555.9 |
| Rideau Petroleums Ltd. | 28 454.8 |
| Beaverhead Resources Ltd. | 27 714.1 |
| Tundra Oil and Gas | 27 605.3 |
| Andex Oil Co. Ltd. | 27 574.1 |
| Geocrude Energy Inc. | 20 657.1 |
| Canadian Roxy Petroleum Ltd. | 20 011.8 |
| Resman Holdings Ltd. | 13 114.3 |
| Samedan Oil of Canada Inc. | 10 329.2 |
| Mead Petroleum & Farms Ltd. | 10 267.7 |
| Resman Oil and Gas Ltd. | 7 687.7 |
| Home Oil Company Limited | 6 588.2 |
| ICG Resources Limited | 5 841.0 |
| Voyager Energy Company | 5 615.7 |
| Canada Northwest Energy Limited | 5 240.6 |
| Trans Canada Resources Ltd. | 5 001.8 |
| Lyleton Corporation | 4 341.3 |
| Murphy Oil Company Ltd. | 4 325.7 |
| Can-Tex Drilling & Exploration Ltd. | 3 537.0 |
| Saskoil Resources Inc. | 3 438.9 |
| Triton Petroleum Limited | 3 058.0 |
| Canadian Reserve Oil & Gas Ltd. | 2 739.4 |
| Koch Exploration Canada Inc. | 2 415.4 |
| Suncor Inc. | 2 325.3 |
| Texaco Exploration Canada Ltd. | 1 823.6 |
| Peregrine Petroleums Ltd. | 1 346.8 |
| Wildmount Resources Ltd. | 1 264.7 |
| John Deroy Gerrand Oil Syndicate | 1 070.1 |
| Other | 9 355.0 |
| TOTAL | 823 321.9 |

| By Field | Vol. ($m^3$)* |
|---|---|
| Virden | 320 496.0 |
| Waskada | 248 705.4 |
| Daly | 167 050.1 |
| Pierson | 20 957.5 |
| Whitewater | 19 895.3 |
| Kirkella | 8 558.6 |
| Tilston | 6 947.3 |
| South Pierson | 6 498.1 |
| Lulu Lake | 3 995.4 |
| Souris Hartney | 2 570.7 |
| Coulter | 750.5 |
| Other Areas | 4 375.6 |
| Confidential Wells | 12 521.4 |
| TOTAL | 823 321.9 |

* *($m^3$) = cubic metres*

Table 13

# Publications

## Manitoba

**REPORTS**

**Departmental Publications**

| | |
|---|---|
| Bedrock Geology Compilation Map 64C | Granville Lake — NTS 64C; 1:250 000, with marginal notes — Manitoba Energy and Mines |
| Bedrock Geology Compilation Map 64B | Uhlman Lake — NTS 64B; 1:250 000, with marginal notes — Manitoba Energy and Mines |
| Geological Map GR87-1-1 In Press: | Geology of the Flin Flon-White Lake area — A.H. Bailes and E.C. Syme |
| Geological Highway Map of Manitoba In Press: | MDA Special Publication No. 1; scale 1:1 000 000 — M.T. Corkery (Map Committee Chairman) |
| Open File Report OF86-4 | Canada-Manitoba Mineral Development Agreement 1984-89 (ERDA) 1986: Sector A Geoscientific Activities, Progress Report 1985-86 |
| Open File Report OF87-3 In Press: | Canada-Manitoba Mineral Development Agreement 1984-89 (ERDA) 1987: Sector A Geoscientific Activities, Progress Report 1986-87 |
| Open File Report OF86-5 | Index to Non-Confidential Assessment Reports — B. Esposito |
| Open File Report OF85-5 | Geology of the Agassiz Stratabound Au-Ag Deposit, Lynn Lake, Manitoba — M.A.F. Fedikow |
| Open File Report OF86-6 | Detection of gold mineralization and lithologic mapping within the Agassiz Metallotect (Lynn Lake area) utilizing black spruce (*Picea mariana*) bark — M.A.F. Fedikow |
| Open File Report OF86-3 | Results of a vegetation geochemical survey near Bissett, southeastern Manitoba — M.A.F. Fedikow |
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| Open File Report OF87-1 In Press: | Till geochemistry of the Seal River area, east of Great Island, Manitoba — E. Nielsen |
| Open File Report OF86-2 | Till geochemistry of the Minton Lake-Nickel Lake area (Agassiz Metallotect), Lynn Lake, Manitoba — E. Nielsen and M.A.F. Fedikow |
| Inventory File | Gold mineral inventory update of the Rice Lake greenstone belt — D.J. Richardson |
| Geological Report 80-9 | Geology of the Cochrane and Seal Rivers Area — D.C.P. Schledewitz |
| Aggregate Report AR 85-3 | Aggregate Resources in the Rural Municipality of Minto — H.D. Groom |
| Aggregate Report AR86-1 In Press: | The aggregate potential of selected Paleozoic and Precambrian rocks in Manitoba — C.W. Jones |
| Mineral Education Series | Sand and Gravel in Manitoba (Supersedes ES78-1) — R.V. Young |

**Departmental Publications** Cont'd

| | |
|---|---|
| Mineral Education Series | Oil in Manitoba — A. Galarnyk |
| Mineral Education Series | Copper and Zinc in Manitoba (Supersedes ES 80-2) — B. Esposito |
| Mineral Education Series | Gypsum in Manitoba (Supersedes ES77-1) — W.R. Gunter |

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(released Nov. 21, 1986; 234 pp.)

Introductory review (1986-87 program)
by W.D. McRitchie

LYNN LAKE DISTRICT

GS-1 Mineral deposit studies in the Lynn Lake area
by D.A. Baldwin

GS-2 Geological investigations in the Sheila Lake-Margaret Lake area
by K. Ferreira

GS-3 Geological investigations in the Foster Lake-Wasekwan Lake area
by K. Ferreira

GS-4 Vegetation geochemical studies, Lynn Lake and Snow Lake areas
by M.A.F. Fedikow

GS-5 The Agassiz Metallotect - Spider Lake area
by M.A.F. Fedikow

GS-6 Till geochemistry east of the Ruttan Mine
by E. Nielsen

GS-7 Till geochemistry in selected areas of northern Manitoba
by E. Nielsen

FLIN FLON DISTRICT

GS-8 Schist Lake area (Athapapuskow Project)
by E.C. Syme

GS-9 Geological investigations in the Tartan Lake-Lac Aimee area
by H.P. Gilbert

GS-10 Mineral occurrence studies — Flin Flon area
by D. Parbery

GS-11 Geology of the Tartan Lake gold deposit
by S. Peloquin, B. Tannahill and G.H. Gale

GS-12 Geology of the Baker Patton area
by B. Tannahill and G.H. Gale

GS-13 Mineralization and alteration of the Vamp Lake sulphide deposit
by R.S. Wadein and P. Laznicka

GS-14 Geochemical analysis of granitic rocks in the Flin Flon-Snow Lake area
by N. Halden and G.S. Clark

GS-15 Chisel-Morgan Lakes Project
by A.H. Bailes

GS-16 Mineral deposit studies in the Snow Lake area
by M.A.F. Fedikow, C.T. Roney, G.J. Schmidt and T.J. Robbie

**Departmental Publications** Cont'd

GS-17 Evaluation of industrial mineral occurrences in the Flin Flon-Snow Lake area
by W.R. Gunter and P.H. Yamada

GS-18 Kisseynew Project: Kississing Lake
by D.C.P. Schledewitz and G. Trembath

GS-19 Kisseynew Project: Geological reconnaissance of Kisseynew Lake west
by W.D. McRitchie

GS-20 Mineral investigations in the Kisseynew gneiss terrain
by G. Ostry

GS-21 Project Cormorant — sub-Paleozoic investigations south of Flin Flon and Snow Lake
by W.D. McRitchie and I. Hosain

SOUTHEAST MANITOBA DISTRICT

GS-22 Stratigraphy of the Manigotagan River Formation, Rice Lake greenstone belt
by D.M. Seneshen

GS-23 Stratigraphy and structure of the upper Stormy Lake Formation, Rice Lake greenstone belt
by D.J. Owens

GS-24 Mineral deposit investigations in the Rice Lake greenstone belt
by P. Theyer and R. Gaba

GS-25 Platinum Group Elements in southeastern Manitoba
by P. Theyer

GS-26 A preliminary investigation of Quaternary placer gold in the Manigotagan area
by E. Nielsen

GS-27 Industrial minerals of southeast Manitoba
by B.E. Schmidtke

GS-28 Subsurface Precambrian geology of southeastern Manitoba south of 49°30'
by C.R. McGregor

GS-29 Additional Precambrian geological information on the Black Island area based on diamond drill and aeromagnetic data
by C.R. McGregor

THOMPSON-CROSS LAKE DISTRICT

GS-30 Butterfly Lake area
by M.T. Corkery

GS-31 Cross Lake-Pipestone Lake anorthosite studies
by H.D.M. Cameron

GS-32 Kiskittogisu-Playgreen Lakes area
by P.G. Lenton, M.T. Corkery and H.D.M. Cameron

GS-33 Nelson River anorthosite evaluation
by W.D. McRitchie

GS-34 Lithological investigations in Inco's Thompson open pit mine
by J.J. Macek

GS-35 Evaluation of industrial mineral occurrences in the Thompson area
by W.R. Gunter and P.H. Yamada

GS-36 U-Pb geochronology program: Northern Superior Province
by T. Krogh, L. Heaman, N. Machado, D. Davis and W. Weber

GS-37 Geochemical characterization of mafic and ultramafic magmatism along the Churchill-Superior boundary zone
by N.M. Halden

**Departmental Publications** Cont'd

NORTHERN SUPERIOR DISTRICT

GS-38 Geological investigations at Ponask Lake
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GS-39 Mineralized pegmatitic granites at Red Sucker Lake, Manitoba
by L.E. Chackowsky and P. Cerny

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GS-40 Stratigraphic mapping and stratigraphic and industrial minerals core hole program
by H.R. McCabe

GS-41 Industrial mineral occurrences in the Duck Mountain area
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GS-44 Rb-Sr geochronology of the Churchill-Superior boundary zone and the Cross Lake area
by G.S. Clark

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by W.R. Van Schmus and D.C.P. Schledewitz

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by P.J. Doyle and J.K. Filo

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(released November 21, 1986)

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by K.L. Neale, J.G. Bardsley and R.M. Lemoine

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by C.R. McGregor

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by E.C. Syme

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by H.P. Gilbert

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**Manitoba Energy and Mines Annual Meeting with Industry — November 21, 1986**

| | |
|---|---|
| Review of Activities | W.D. McRitchie |
| Highlights of the Provincial Minerals Investigations Program | G.H. Gale |

**Presentations** Cont'd

| | |
|---|---|
| Highlights of the Provincial Geological Mapping Program | W. Weber |
| Provincial Industrial Minerals | W.R. Gunter |
| Quarternary Investigations, a Review | E. Nielsen |
| Geological Survey of Canada Mineral Development Agreement Programming | A.G. Galley |
| Applied Geoscience Research at the University of Manitoba | N. Halden |
| A proposed model for Winnipegosis reefs in Manitoba | H.R. McCabe |
| The nature and timing of synvolcanic plutonism, hydrothermal activity and Zn-Cu sulphide mineralization, Chisel-Morgan Lakes area | A.H. Bailes |
| Falcon Lake Igneous Complex, new perspectives | W.C. Brisbin |
| Geochemistry and biogeochemical investigations of the Agassiz Metallotect | M.A.F. Fedikow |
| Structure and stratigraphy of the Kisseynew gneisses, at Kississing Lake | D.C.P. Schledewitz |

**OTHER PRESENTATIONS**

MDA projects specific to Lynn Lake district
by D.A. Baldwin, at Lynn Lake Town Council, May 1986.

Industrial Minerals of Manitoba
by W.R. Gunter, at Geological Sciences Building, University of Manitoba, March 1987.

Industrial Mineral activities in Manitoba
by W.R. Gunter, at Biennial Conference of Federal and Provincial Industrial Minerals Geologists. Ottawa, October 1986.

Review of Provincial Sector A activities for 1986-87
by W.D. McRitchie, at CIM Winnipeg Section, April 1986.

Quarternary overview of Northwestern Ontario, Manitoba and Saskatchewan
by E. Nielsen, at CIM Winnipeg Section, November 1987.

Gold in the Churchill Province, Manitoba
by G. Ostry, at CIM Snow Lake and Flin Flon, March 1987.

Geology and characteristics of granitoid rocks in the Southern Indian Lake, Seal River and Chipewyan domains
by D.C.P. Schledewitz, at Lithoprobe Workshop, University of Manitoba, April 1986.

Industrial Minerals of Manitoba
by B.E. Schmidtke, at Geological Engineering, University of Manitoba, March 1987.

Geochronology and evolution of the Rusty Lake-Lynn Lake greenstone belts
by E.C. Syme, at Lithoprobe Workshop, University of Manitoba, April 1986.

Platinum group element exploration in Manitoba
by P. Theyer, at CIM Snow Lake and Flin Flon, March 1987.

The Manitoba transect of the Trans-Hudson Orogen
by W. Weber, at Lithoprobe Workshop on Trans-Hudson Orogen, University of Manitoba, April 15, 1986.

**FIELD DEMONSTRATIONS**

Syme, E.
Field demonstration of Flin Flon-White Lake geology to Swedish geologists from Bolden, July, 1986.
Syme, E.
Field demonstration of Flin Flon-White Lake geology to GSC geologists, July 1986.

Macek, J.J., Weber, W. and Zwanzig, H.V.
Field trip demonstration in Thompson (Thompson Pit), Sipiwesk Lake and Setting Lake for 20 members of FONB (Friends of the Nickel Belt) geologists from governments, universities and mining industry interested in new developments of the geology of the Thompson belt (3 days in June).

Table 14

## Energy Consumption by Type of Fuel

Manitoba 1984-1986

***(terajoules)***

| Type of Fuel | 1984 | % | 1985 | % | 1986 | % |
|---|---|---|---|---|---|---|
| Refined Petroleum Products | 100,236 | 42.6 | 101,352 | 42.0 | 99,064 | 41.5 |
| Natural Gas | 74,007 | 31.4 | 76,494 | 31.7 | 74,556 | 31.2 |
| Electricity | 54,873 | 23.3 | 57,285 | 23.8 | 58,398 | 24.5 |
| Coal and Coke | 2,767 | 1.2 | 2,650 | 1.1 | 2,704 | 1.1 |
| L.P.G.'s | 3,089 | 1.3 | 3,095 | 1.3 | 3,632 | 1.5 |
| Steam | 427 | 0.2 | 272 | 0.1 | 429 | 0.2 |
| TOTAL | 235,399 | 100.0 | 241,148 | 100.0 | 238,783 | 100.0 |

*Source: Statistics Canada, Manitoba Energy and Mines*

***Note:*** *Not adjusted for weather*

Table 15

## Energy Consumption by End-Use*

**Manitoba 1984-1986**

***(terajoules)***

| End-Use Sector | 1984 | 1985 | 1986 |
|---|---|---|---|
| Residential/Farm | 49,240 | 52,463 | 50,859 |
| Commercial | 47,306 | 48,136 | 47,638 |
| Industrial | 37,711 | 38,806 | 41,237 |
| Transportation | | | |
| Farm Machinery and Equipment | 9,267 | 9,829 | 10,970 |
| Road | 53,426 | 53,519 | 51,161 |
| Rail | 10,723 | 11,114 | 10,247 |
| Air | 6,909 | 6,899 | 7,087 |
| Marine | 18 | 20 | 15 |
| Sub-Total | 214,600 | 220,786 | 219,213 |
| Non-Energy Use** | 3,855 | 3,924 | 3,660 |
| Energy Industry Use, Losses and Adjustments | 16,944 | 16,438 | 15,910 |
| TOTAL | 235,399 | 241,148 | 238,783 |

*SOURCE: Statistics Canada, Manitoba Energy and Mines*

* *Not adjusted for weather.*

** *Products such as asphalt and lubricating oils and greases which are used for purposes other than their energy content.*